Vol. 107 No. 2678 THURSDAY Sept 18 1952 9d.

THE MODEL ENGINEER

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PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

18TH SEPTEMBER 1952 VOL. 107 NO. 2678

SMOKE RINGS

Our Cover Picture

● THE DEVELOPMENT of the small flash steam plant, and in particular its application to the propulsion of model speed boats, is a task which calls not only for the highest ingenuity, but also dogged persistence and a complete disregard of convention or " established practice " From the very earliest days of model speed boats, flash steam has always attracted the most adventurous spirits, and the exploits of pioneers such as Teague and Delves-Broughton, H. H. Groves, Fred Westmoreland and S. H. Clifford have achieved a well-deserved immortality, It is to be deplored that, in modern times, activity in this particular field has declined and even some of its former adherents have forsaken flash steam in favour of the somewhat less temperamental and more stereotyped i.c. engine ; at present there are only two or three stalwarts who consistently support the cause of the flash steamer. Among these, the name of Mr. B. J. Pilliner, of Southampton, has recently become prominent, although he is by no means a newcomer to this field of endeavour, having served his novitiate before the war in the Guildford club, in company with those equally redoubtable flash steam exponents, the Jutton brothers. His latest boat *Frolic*, which is seen here, put up an " A " class flash steam record at the Southampton regatta with a speed of over 58 m.p.h. In keeping with the true pioneer spirit, both the hull and power plant of this boat are highly original. The boiler, of the coil type, has a vaporising burner fed directly from an engine-driven pump, and its single-cylinder engine is fitted close against the stern transom, the flywheel being outside the hull, and equipped with vanes to serve as a surface propeller.

Several alterations have been made to the boat in the course of experiments ; it will be noted that in the photograph, the propeller-cum-flywheel is displaced towards the starboard side of the hull, with the intention of correcting a tendency of the boat to yaw in getting away. In this respect, we understand, it was quite effective, but introduced other undesirable features, and it has now been replaced on the hull centre-line. Mr. Pilliner has also experimented with an aerofoil in front of the bows, having negative incidence to counteract the tendency to " flipping," or turning over backwards at high speed through airlift under the forward planes. Whatever may be said in criticism of this, or any other of the model speed boats which have been illustrated or described in the " M.E.," there can be no doubt that they are the result of careful thought and long painstaking research work, often entailing many failures and bitter disappointments ; their merit as engineering achievements, therefore, cannot be denied or disregarded.

Good Advice—Oh, Don't!

● WE WERE, naturally, looking for something totally different in a back volume of THE MODEL ENGINEER when we came across the following notes headed "Don'ts," by F. Percival, and we think they are well worth reprinting :

As our Editor is not progressive enough to give away paper blouse patterns, or to include "Hints on Beauty" in his journal, it seems almost a waste of time to cast these pearls before our "Fair Readers." Still, if this number should be carefully left open at this page between "Home Chat" and "Fashions for All," I think these "Dont's" may be read in the right quarter.

So, fair reader, if you have the misfortune to be engaged to a mechanic-mad male, and he takes you for a tour of his workshop to admire the results of his inventive genius—

Don't say : "Oh, what a funny little wobbly thing." Call it eccentric, it sounds better, even if it is the connecting-rod.

Don't say, when he shows you his $\frac{3}{4}$-scale locomotive : "I do like your pretty little train." Remember loving hearts have parted for less than that.

Don't say : "You do love me more than your silly old workshop, don't you ?" There are probably enough black marks against him already.

Don't say : "When we're married I can store my rubbish as well in the workshop, can't I ?" It isn't tactful.

Don't, when he is using a $\frac{1}{16}$-in. drill, give him a sudden loving hug. Drills cost money.

Don't give him a 2s. 6d. "Our Boys" tool outfit for his birthday present. He may go black in the face trying to thank you.

I conclude in the hope that these few modest hints may smooth love's pathway, until the time when just as he's in the middle of a job he hears a voice calling "Come down at once dear, supper's waiting."

Old Traction Engines

● MR. JOHN E. BREWER'S letter published in our July 31st issue has brought us a reply from Mr. C. H. James of the firm of James & Sons, Heavy Haulage Contractors, Kingswinford. Referring to the question Mr. Brewer asked about an old ploughing engine he had seen on the Wolverhampton-Birmingham New Road, Mr. James writes :—

"I can give some first-hand information. We took this old engine to a Birmingham scrap-yard in April of this year. The gearing and the rear wheels were saved. Where Mr. Brewer saw this engine standing was the scene of its last job ; it was used for the levelling of that piece of land. The man who drove the engine accompanied us on her last journey. She was owned by J. B. Carr, of Tettenhall, Wolverhampton. I believe they still have two engines in operation.

"One of your readers was asking if anyone knew what had become of the big Fowler *King Carnival*. This engine is in daily use at the works of John Thompson, boiler makers, of Wolverhampton, and is in excellent condition.

"We ourselves operate a similar engine, Fowler No. 17106. The nameplates are *Duke of York*, but we do not know whether these are original. The engine is fitted with a special crane capable of lifting about 14 tons, and it originally belonged to Edward Box. We have been hired to do several unusual jobs with this engine. A few weeks ago, two mobile cranes were hired to lower a boat into the River Severn. The boat pulled one crane into the river, and the big Fowler had the task of hoisting this mobile out of the mud and water ; she did it in no uncertain fashion. The mobile weighed 11 tons."

We are forming the opinion that when there are, literally, no more road engines available, these "unusual" jobs are going to prove very difficult to deal with. The legitimate work of the steam road locomotive may have been taken over by other means of locomotion ; but the road locomotive is obviously adaptable to awkward lifting problems and other uses requiring haulage which are not so easily accomplished by other machines.

Mr. C. B. Collett

● WE WERE very sorry to learn of the death of Mr. Charles Benjamin Collett, Chief Mechanical Engineer of the Great Western Railway from 1922 till 1941. He died at his home on August 23rd, aged 81, after a period of failing health.

Mr. Collett's main claim to fame was due to the faithful and unwavering manner in which he carried through the plans for standardisation and development laid down by his great predecessor, G. J. Churchward ; these plans provided for the needs of G.W.R. locomotive power for more than forty years, and entailed the production of such well-known engines as the "Castles," "Kings," "Halls," "Granges," "Manors" and the delightful "2250" class of 0-6-0 freight engines.

So far as we know, Mr. Collett did not practise model locomotive building, but he took a keen and kindly interest in the craft ; he never refused to give information that would help anyone to construct an accurate reproduction of a G.W.R. locomotive ; he was no stranger to the regulator of a miniature locomotive, and he well knew the "Polar Route" of our good friend "L.B.S.C."

The last time we met Mr. Collett he was coming out of Bonds o' Euston Road as we were going in, and we have sometimes wondered what business took him there. But our recollections of him will always be of his tall, rather stately presence, his friendly manner, his earnest desire to help and his remarkably soft, musical voice. He was a railwayman, through and through ; yet anyone less like the popular conception of a railwayman would be difficult to imagine. He was regarded with respect and even affection by those who worked under him on the G.W.R., and although, of late, he had been rather out of touch with his former colleagues, there are many of them who mourn the loss of a true friend. And his name will endure, in time to come, for just so long as any interest in locomotive history remains ; his "Castles" and "Kings" alone, on account of their superb performances, will ensure that Mr. Collett's name will never be forgotten.

Apart from this, however, it is probable that Swindon will remember him best for his experimental work in connection with locomotive efficiency ; probably no other mechanical engineer achieved so much in this direction, and the work proved its worth soon after the nationalisation of our railways.

"Co-Co"——by Bill Worrall (Reading S.M.E.E.)

The story of a 5-in. gauge experimental electric locomotive under construction

WHAT makes one decide to build a particular model? Doubtless we all have our own separate and sometimes secret reasons, often there is but the desire of creation, sometimes the urge to go one better than one's fellows. In this case it was a result of an unspoken challenge. A tale is best told from the beginning, so let's be off.

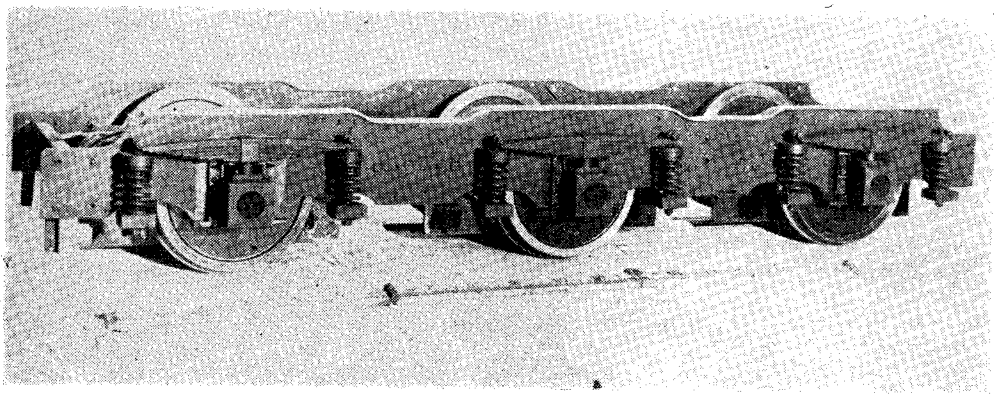


Photo by] [*M. H. C. Voake, M.P.S.*
No. 1 *bogie in working order, minus brake gear, pivot and drag gear*

One evening in 1950, our then chairman, Maurice Neville, announced that he was acquiring an M.L.7 lathe and would also set up a proper workshop. This occasioned some surprise, as up till then he had been a very ardent and exclusive "OO" gauge merchant, building all his own locomotives and so on, but had never seemed to be ambitious regarding general workshop practice.

It was tacitly understood that it may have been the result of arduous wooing on the part of Stevie, in charge of Tools and Workshop Section. However, that is as may be. Judge our next amazement when, after a short lapse of time, Maurice announced he was selling his entire "OO" equipment—everything.

"Why?" asked the "OO" boys. "Oh, I'm going to build a live steamer," he replied.

"Go on, you're kidding."

"No, definitely a 'live steamer,' and my choice is a 5-in. gauge *Minx*."

Great Scot, from "OO" to 5 in. in one leap! This was amazing; and considering Maurice, to our knowledge, had little or no lathe experience previously, he was certainly biting off a large piece, to say the least.

Nevertheless, he had made up his mind and, despite friendly advice from the live steamers, few of whom as yet had ventured above $\frac{3}{4}$ in. scale, he purchased a whole range of materials and waded in. Within a very short time, the frames duly appeared, and very nicely cut too. Wheels, boxes and axles followed in short order. We thought, "Aha! Wait till he starts on the cylinders." But no, he followed the "words and music"; lo and behold, he made a very nice job.

Of course, during this time, there had been an interchange of some badinage between us "OO" modellers and the erstwhile cohort, until one day Maurice retorted: "Don't know why you toymakers don't make a *real* engine instead of playing trains." What reply was elicited cannot be recalled. I don't think it was particularly rude, but it bore fruit.

The next week friend Wally and myself visited the "M.E." Exhibition. Going home, I said: "I'd rather like to take Maurice up." Wally replied: "Why not?"

Followed then a very lively discussion. If we were to accept this "challenge" what should the "real" engine be? Obviously, it would have to be a passenger-hauler, preferably 5-in. gauge. But, strangely, we didn't fancy steam, possibly because we were both fairly ignorant as to live steam, although admittedly we could follow a tested design. And, too, we would like to be different. A fully-working model of the L.M.S. 10000 diesel electric was considered. Other prototypes (none steam) were discussed; but it all boiled down to electric final drive, whatever the prime mover.

This brought its first problem—motors.

Could suitable ones be secured? And, in any case, what power would the motor have to supply? And so on. It was also decided that the project should be kept secret as long as possible. Why? Just for fun! We're still boys.

The following week, I was rung up by Wally, who joyfully announced that he had discovered some motors that might do for size, in his pile of *ex*-Govt. "junk."

Meanwhile, I had been ascertaining back to back dimensions of 5-in. gauge models and a few other salient points by looking through many back numbers of "Ours." Little was to be found about electric locomotives, and nothing giving drawbar pull, although we found a few figures for live steam locomotives, which were needed as a guide for what to aim at. It would appear that we must aim at 60-70 lb. drawbar pull, in order to do better than a *Minx*. You see, we were out to go one better than Maurice, whose remark, by this time had developed into a sneer, ringing in our ears as a definite challenge. Amazing what imagination can do!

Well, along came Wally with two motors for test, with two meters and a pair of sweet-shop scales with weights.

First, we established the motors were O.K. for size. Would they fit in between the wheels? Yes! They also were complete with a compound 50 : 1 gear train, which could be altered to 2 : 1, 5 : 1, 10 : 1, 25 : 1. Very nice, too! Next, they were series-wound, a practical "must" for traction jobs. Rating 24 V, d.c. or a.c., 0.5 A, i.e., 12 watts. Bit too low, we thought.

However, we rigged up the meters, attached a foot-long beam to the 50 : 1 gear train, screwed the motor to the bench, placed one end of beam on scale pan, applied voltage to motor, and weighed the resultant torque. Pretty good! Up went the voltage, more weights.

Right, let's go further. We borrowed a tachometer and a spring balance, max. 40 lb. plus two more meters. To the 10 : 1 ratio gear train was attached a 1⅞ in. beam, this represented the approximate inches to radius of a model road wheel (for 1$\frac{1}{16}$ in. scale). Again the motor on test was strapped to bench, the short beam attached to the spring balance, which was in turn suspended from a broom head, its handle being nailed to the bench. On went the juice—24 V 2.5 A—30 V, 3.3 A—36 V 4A—, steadily the pointer came round, torque 5 lb-8 lb., 10 lb. Amazing results, we thought. We felt the violently buzzing motor. Yes, getting warmer and, by jove, getting—*hot*. Switch it off quick! Incidentally, the off load speed on 30 V was around 12,000 r.p.m. at armature shaft. This was good, very promising. Try another—same results. How long to get hot? 1½ min. at 40 V.

Next thing was coupling the two motor spindles together for an efficiency test, one driving, the other connected as a generator. Input voltage and current were compared with the output ditto, efficiency therefrom being low, as expected, averaging 45 per cent. This is usual in small motors; the dimensions of the motor body are 3 in. long, 2½ in. dia. with ¼ in. spindle.

So far, so good—one motor per axle, presuming four axles at 30 V, a total of 400 watts, about ½ h.p. Any good? What drawbar pull could we expect from ½ h.p.? The torque test, or stalling torque showed 32 lb Not enou h to beat "Minx," we considered. Therefore, we must have more axles on our model—say six, that gives us 600 watts or 48 lb. torque. H'm. "Hey, what's to supply the power? Look at the total amperage—3.3 per motor by six equals 20 A load approximately."

"Yes, but it wouldn't be for long; after all, we've only got to get the load moving."

"Sure; but 20 A will mean car batteries, and three of 'em to get the 30 V plus. And car batteries ain't cheap."

"That's so, but neither is a 5-in. gauge boiler."

"Oh, well, we can hardly expect to do the job for nothing, so let's have less economics for the moment. What prototype could we use?"

"L.M.S. diesel-electric?"

"H'm; difficult plate-work each end could be managed, but would prefer a simpler job, if there is one."

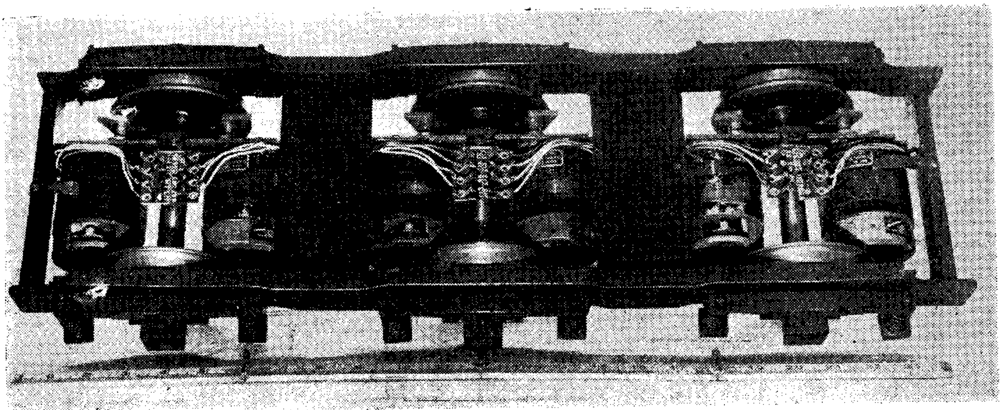


Photo by] [*M. H. C. Voake, M.P.S.*

No. 1 bogie, plan view

(Pause for cogitation.)

(Further pause for a "cuppa.")

"Let's have a look at those railway books."

"Hey, what about this one?"

"Oh, the Southern Co-Co. Yes, but it's still got a blunt nose to the roof."

"Hi, look here, 20003 has a plain front end, O.K.?"

"H'm, seems all right. Let's have a look."

included, but, as in all G.A. drawings they certainly required much study, and that continually, especially as one is not conversant with the separate parts.

Fun with the scales has been experienced as the drawings varied from $\frac{3}{4}$ in. through $1\frac{1}{2}$ in. to the foot! And we wanted $1\frac{1}{16}$ in.! The slide-rule comes in handy again! Personally, I didn't see the necessity of drawing the whole thing out,

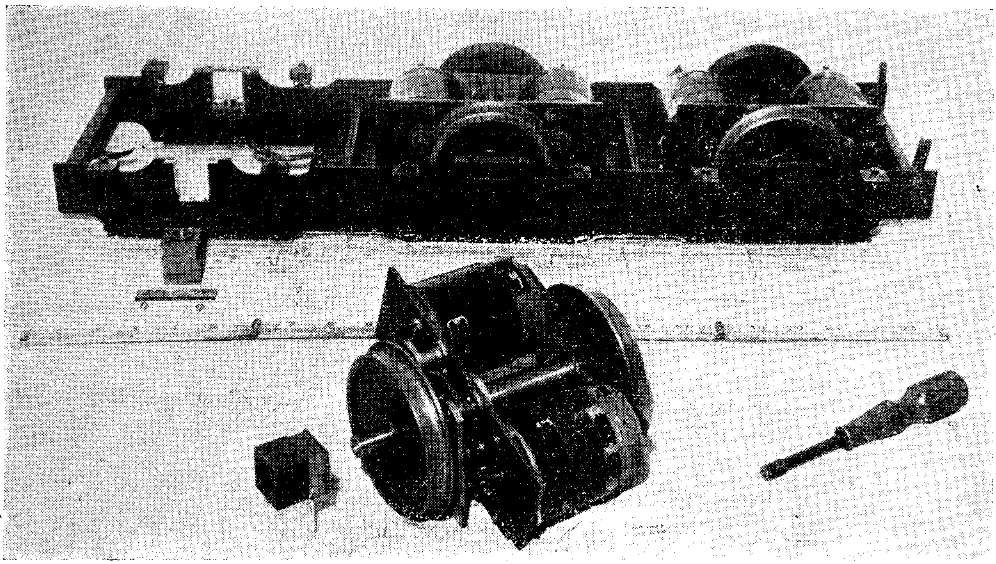


Photo by] [*M. H. C. Voake, M.P.S.*

Demonstrating ease of withdrawal of twin-motor drive assembly

"Yessir, not at all a bad effort for us—think it might do at that."

"It's got a pantograph, which wouldn't ever be used on the model, considering it is for passenger-hauling only."

"Well, what of it? It's also got collector beams, too, which gives us a good excuse for electrifying the track."

"Good enough, so far; let's go to bed and sleep on it."

"Right, wouldn't it be amusing to put tonight's experiments on, as a club programme one night. The scale and broom lash-up should be a laugh?"

"Yes, we'll do that some time."

And so to bed.

We did put that demonstration on and it was well received too, especially as Wally conceived a few more electrical devices, complete with flashes and explosions! But, back to the tale.

The next step was to obtain particulars of the S.R. 20003 and a request letter was despatched to the appropriate source. Three weeks later five drawings, an excellent photograph and a general description of the working details of the locomotive were received.

The drawings gave a general arrangement of driving bogies, main frame or chassis, body side sheeting and front. Several sections or cuts were so I inserted the actual dimensions on the prints, and that's a nice fireside job, if there's no one else around, as the said prints cover quite an acreage.

Scaling the internal dimensions of the body showed that one size of heavy duty battery could be contained therein. Question, could a Nife type cell go in, as these would be a better buy? Lists were perused. No, it couldn't. Never mind. Stick 'em on a separate truck. No, we want the job to be self-contained; and besides that, the heavy batteries, 3 off at 75 lb. apiece, would provide adhesion and then some. A further important point; could enough of the same type of motor be obtained? Many hours diligent search on Wally's part produced ten good ones plus two very damaged and practically useless, as end fixtures were broken.

And so the die was cast. If we were to make a 5-in. gauge job, it would be electric and to the 20003 prototype. No actual start was made for quite some months. Wally gave a talk to the club on control of electric locomotives, and there was the joint demonstration previously mentioned, but following an obvious interest on our part in live steam performances generally, a few of the boys got suspicious and started a "probe." As a result, I got some $\frac{1}{8}$ in. plates, bolted up a sandwich of four and carved out the bogie frames

in one go on the 5-in. Atlas lathe, by end-milling, producing these just about the time that the whole "gaff" blew up. The whole project caused much interest and debate. Critics stated we couldn't possibly beat the live steamer in this scale, quoting this, that and the other to prove their points, until I, at least, had many misgivings. However, we boasted we could and would show these chaps up—and the challenge was on.

Now a pattern for the wheels was made (no castings being commercially available—why?) and sent to a foundry. ¾ in. dia. M.S. was used for axles, bearing ends reduced to ½ in. dia. and ½ in. dia. for wheel seats. As motors had to be axle-hung provision was made. This was done by utilising Morganite bushes, as used in motor-car starters, revolving loosely on the axles within the wheels. A large gear wheel was taken from the motor gear train, rebushed and bored to force-fit on axles, then taper pinned. Motor end and gear side plates were cut from ⅛ in. plate slotted to fit sleeve on axle. A spit (marine) type end housing is used to hold gear in mesh. Outer side of motor was to be suspended, as prototype, on nose brackets.

At this stage, the wheel castings arrived and were rough turned, 20 off—the eight extra were needed for a passenger car. We had moral courage!

Six were finished off in short order, pressed on to axles by hydraulic press, 6 tons per sq. in. needed. One was hammered off because I had put the drive gear on the wrong way round! And then hammered on again. Shows what a hammer can do!

Next tackled were axleboxes, m.s. 1 in. × 1 in. × 1⅛ in. long. Did the twelve in one set-up. Bored ⅝ in. press fit for said bushes. No ⅝ in. expanding reamer to hand.

I decided we ought to have horn blocks, so bought some ½-in. scale type *ex* Reeves, hot brass pressings—very clean job. With little fitting they dropped nicely into the frame slots and were affixed by seven $\frac{1}{16}$-in. rivets each. Although they do not use this type on the prototype, I thought they would save time. Now, later for certain reasons, I find I shall have to change them to correct type. In fact, l. and r. hand patterns are in hand.

Two of the cut-out frames were bolted together, and the horn blocks milled out. The axlebox slots were milled to a tight fit in horn blocks. I realised after this had been done that it was a silly way, especially after the number of times "L.B.S.C." has given us the correct order of doing these jobs. One learns by doing.

Main bogie stretchers were next on the list. I decided to fabricate from m.s. plate and angle, riveted and brazed. Two are needed for each bogie. Incidentally, it is surprising how much out of square is drawn m.s. angle, each piece had to be turned square! Many hours of work later, two stretchers were produced in the rough, then machined square and to size by fly-cutting. Two small bolts fastened them to one bogie side frame only. The other side frame was temporarily clamped up to the other end of the stretchers. Axles and boxes were pushed in (still tight) and the whole lot squared up on a surface plate, fiddling about with the clamps and a hammer until all axles ran freely and the frames were square and showed little rock, actually 10 thou. in 24 in. Clamped side of frames were then drilled and bolted to stretchers. Two channel stretchers were made up and inserted at front and rear ends of bogie. Horn blocks were now eased and axleboxes relieved to give necessary freedom and the wheel and axle assembly refitted.

The whole effort was given a trial on the floor and ran satisfactorily. And now to fit a trial motor assembly. At this stage, misgivings about the results we could expect had reached high levels, and a good idea struck us. Why not fit two motors per axle instead of one. After all, it wasn't cheating, as the blessed things were less than 50 per cent. efficient, or better put 55 per cent. inefficient! As there were ten motors, should it be five per bogie or six and four? Or could we get hold of two more? Many trails were followed to find the additional pair, but to no avail. In the meantime, it was decided to fit the first experimental bogie with six motors. A trial assembly of two motors was mocked up, both driving on to the same axle gear and placed one to each side of the axle, in fact, like a see-saw. As the weight of one balanced the other, nothing further than a small strip of clock spring was needed to counteract the turning movement as the motors started up. Now we could give it an initial trial. The bogie was placed on the floor, two 12-ft. leads attached to the Variac and rectifier and juice applied. The bogie shot away on 15 V and clouted an oak table, moving it a few inches. A small spring-balance was attached, the other end being nailed to the floor. At 4 lb., the wheel flanges skidded, so a few chucks, lumps of iron and a gallon tin of flux were balanced as adhesion weight. The spring-balance showed 9 lb. T.E. and the wheels still slipped on 24 V at 4 A. Good!

Some weeks later, four more motors were fitted as the first two, but, unfortunately, a rather long wait elapsed before further work was undertaken.

In the late summer, the bogie was taken as a loan to the Oxford Society's exhibition and to create a bit of fun, shown alongside the chairman's *Minx* chassis. A showcard calling attention to the efforts of two "OO" gaugers, entitled "Hot Watts v. Hot Water" or "Will 'Co-Co' beat *Minx*?" was placed at the rear and caused some amusement and comment.

By now, "Co," being half of "Co-Co," was getting a bit lumpy, so I had to wait until Wally could take it down to the clubroom in his car for further trials. There, one evening, we lashed up, or wired the motor leads, having some trouble in sorting them out, four per motor, so they would all run the same way. After shorting out the battery on several occasions success was attained, and it was placed on 15 ft. of spare club track. Four *ex*-W.D. batteries, weighing 80 lb. apiece, were balanced, two on the bogie and two on an old 5-in. gauge tender, which latter was hitched to the bogie by 15-amp flex.

(*To be continued*)

Making a Workshop Camera

by

" Dioptre "

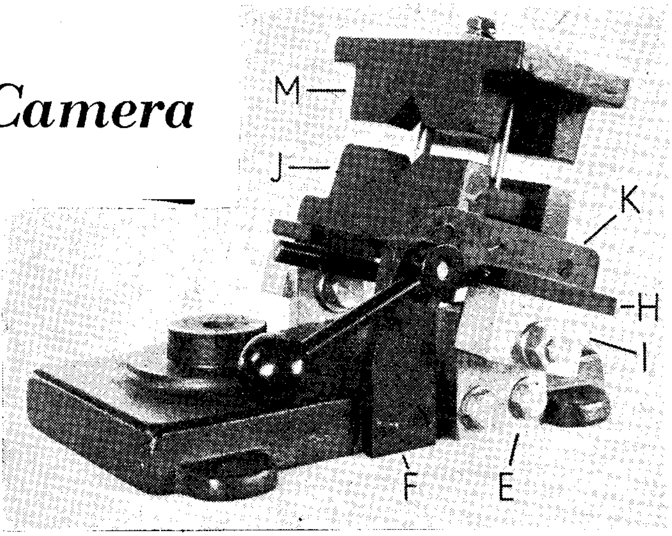


Fig. 11. *The baseplate and tilting bracket*

NOW that the cast-iron bedplate has been machined and mounted in place with its clamp-screw on the baseboard, the next step is to build the tilting bracket in which the bar bed is held.

The Pivot Table—H

Reference to the illustrations will show that this flat table is fitted with a trunnion block, *I*, at either end, and the trunnion bolts pivot in the two side members, *E*, which are in turn attached to the bedplate. These bolts are made a working fit in the side members and a press fit in the trunnions, so that the nuts will not turn with the movement of the bracket as a whole.

Continued from page 322, "*M.E.*," *September* 4, 1952.

The Lower V-block—J

It will be seen in Fig. 4 that no less than five V-blocks are used in the construction of the camera and, to save time, the accurately machined saddle V-blocks manufactured by Messrs. Myford were employed for this purpose.

In the ordinary way, however, expense will be saved if iron castings are used. All five blocks are machined on their base surfaces, and the 90 deg. V is cut to the same depth in every case.

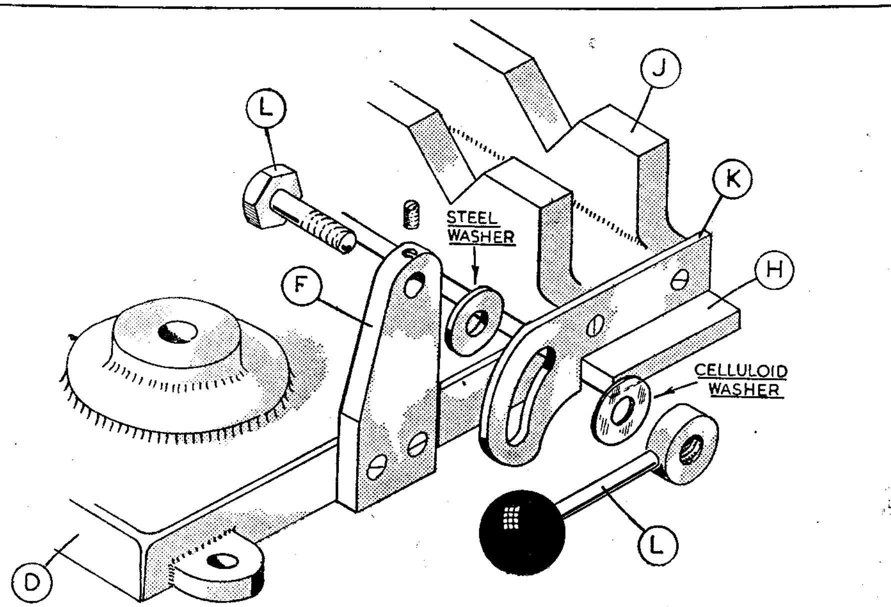


Fig. 12. *The baseplate and table assemblies.* " *D* "—*baseplate* ; " *F* "—*base clamp-plate* ; " *H* "—*pivot table* ; " *J* "—*lower V-block* ; " *K* "—*quadrant* ; " *L* "—*quadrant clamp-bolt*

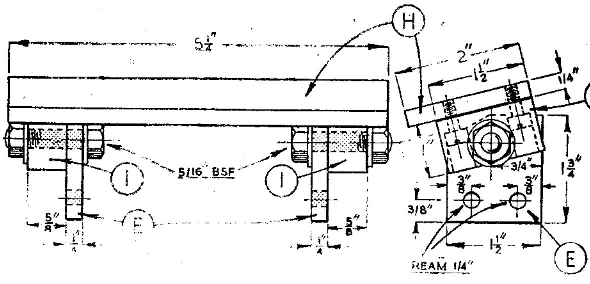


Fig. 13. *The pivot table assembly*

This work can quite well be done in the lathe by gripping the casting in the four-jaw chuck for facing the under side of the base to form a datum surface ; the work is then mounted on the saddle, and the two limbs of the V are machined either with a milling cutter or a fly-cutter. However, if a small shaping machine is available, both operations can readily be carried out with the casting mounted in the machine vice.

When machining the V, it may be found more convenient to mount the work on the saddle or in the shaping machine by employing two angle-plates bolted together in the way shown in Fig. 16. The upper plate is firmly secured to the lower at an angle of exactly 45 deg. with the aid of a protractor. This setting will align one limb of the

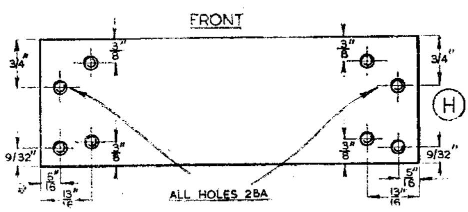


Fig. 14. *The pivot table*

V horizontally and the other vertically.

The angle-plate can be set at right-angles to the lathe axis by mounting the test indicator in the chuck, and then feeding the cross-slide backwards and forwards while the indicator plunger presses on the work face of the angle-plate. Before starting the machining, the V is carefully marked-out from the centre-line of the casting. If a V is not cast-in, the suplrus metal should, first, be cut away with the hacksaw and file so as to leave only a small amount of material to be removed by the machining operation.

In the same way, a cast-in V should be filed nearly down to the dimension lines, both to remove the surface scale and to ease the machining. In order to eliminate any tendency on the part of the finished block to rock or twist on the bar bed, the bed should be smeared with marking paste and the V-block tried in place ; if necessary, hand-scraping is employed to obtain even contact.

Next, the holes for the holding-down screws are drilled through the base to correspond with those in the table itself, and the two parts are then fixed together. The clearing-size hole, shown in Fig. 14, for the passage of the $\frac{5}{16}$ in. dia. clamp-bolt is now drilled right through both components on the centre-line of the V.

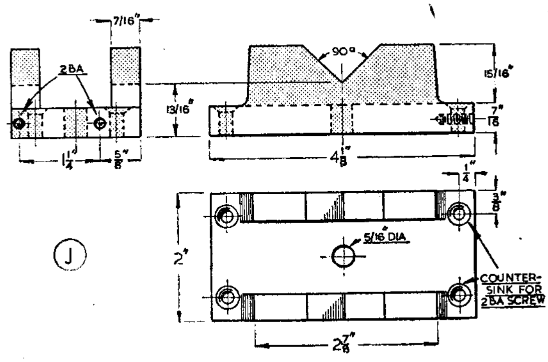


Fig. 15. *The lower V-block*

The Quadrant—K

This component is made from ⅛ in. × 1½ in. mild-steel strip ; but before it is cut to shape, the centre is found for scribing the two arcs outlining the curved slot in the quadrant. The finished quadrant is then attached to the base of the V-block by means of two 2-B.A. screws.

The Base Clamp Plate—F

This plate serves to clamp the quadrant and so lock the tilting bracket carrying the bar bed.

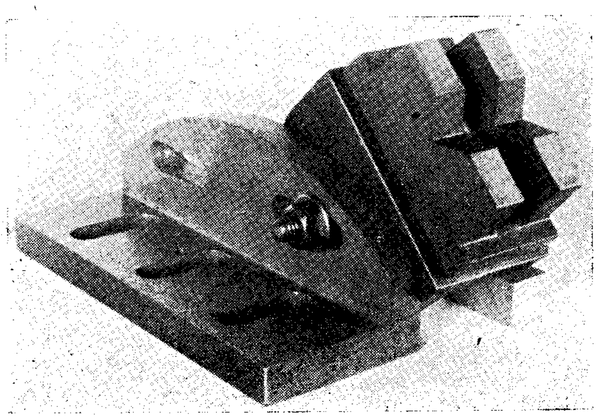


Fig. 16. *Mounting a V-block casting for machining*

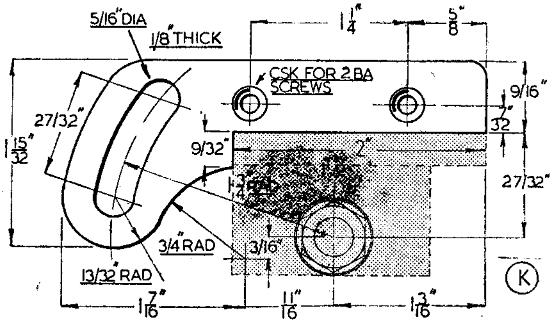


Fig. 17. *The quadrant*

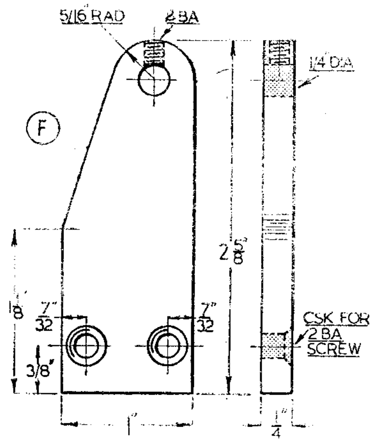


Fig. 18. *The base clamp-plate*

It is made from ¼ in. × 1 in. steel strip and is secured to the baseplate with two 2-B.A. countersunk-head screws. If this part and the quadrant have been correctly made and fitted, the clamp-bolt will clear the sides of the curved slot and no filing will afterwards be needed. An Allen grub-screw is fitted to prevent the clamp-bolt turning.

The Quadrant Clamp-bolt—L

A standard bolt of the right length can be used, or the screw can be machined with a round head if a tommy hole is drilled across the head to enable adjustments to be made. The clamp lever is built up in the same way as the base clamp handle, but here there is no need to make the shank detachable, as the nut can be engaged by turning the clamp-screw.

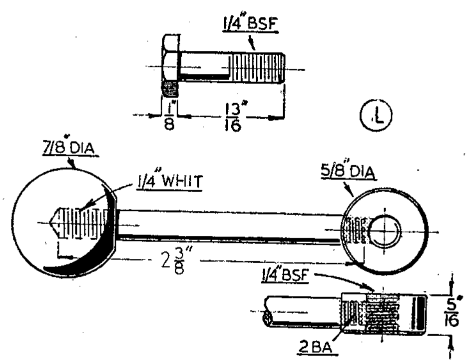


Fig. 19. *The quadrant clamp-bolt*

When fitting the clamp-bolt, a ¼ in. steel washer is put between the plate and the quadrant and, as represented in Fig. 12, a celluloid washer is placed under the nut to protect the paint.

With the clamp lever raised to the horizontal position, the clamp-screw is firmly tightened and then secured with the Allen grub-screw.

On depressing the handle, the main pivot should move quite freely ; if not, a further adjustment of the clamp-screw must be made.

It will be found that quite light clamping pressure will lock the pivot joint securely, for clamping the quadrant at a distance of 1¾ in. from the turning centre is much more effective than trying to secure the tilting bracket by tightening its pivot bolt.

Finishing Metal Parts

As previously mentioned the metal parts of the camera chassis are finished by painting with optical black, and this holds good for nearly all the metal work, except the knurled finger-nuts, used for locking the camera movements, and some of the brass fittings attached to the woodwork of the camera proper.

The brand of optical black employed is known as "Ebonide" and was supplied by Messrs. Canning & Co., 77, St. John Street, Clerkenwell, London, E.C.1. This preparation can be sprayed on at a pressure of not more than 25 p.s.i. but with a little practice good results can be obtained by brushing. To avoid brush marks, the lacquer must be allowed to flow on to the work, and runs can then be avoided by keeping the work moving until the paint has begun to set. The lacquer dries quickly and forms a very resistant coating with a pleasing, matt finish on all kinds of metal-work. This preparation also serves well for wood finishing ; but to obtain a uniform, smooth surface, it is advisable to prepare the wood by first filling the grain and then rubbing down with fine glass paper. Where a true, dead black is required to prevent reflection within the camera, Johnson's camera dead black will be found more suitable.

(*To be continued*)

For the Bookshelf

The 1953 Gadgets Annual. (London : Postlib Publications.) 168 pages. Illustrated. Price 10s. net.

We have been favoured with a copy of this book, which contains brief descriptions and illustrations of no fewer than 500 easily-made gadgets devices and contrivances. They have been reprinted from the popular *Gadgets Magazine*, and they seem to meet almost every possible need ; the majority of them require only the most meagre of workshop equipment.

"Talking about Steam——"

by W. J. Hughes

A series of articles intended to supply suggestions and information for the would-be "modeller in steam" who has not the time, inclination or the opportunity for intensive research

9.—Tyros' corner; and a Winding-engine

IN an earlier article, I mentioned that Wansbrough, in his book *The Portable Engine*, quotes figures to show theoretically that one engine working at 45 p.s.i., with no cut-off, will use 15 cwt. of coal in a ten-hour day, whereas the same engine, working at 55 lb. and cutting off at half-stroke, will use only 8 cwt., but will do the same work.

Now this statement has puzzled some tyros, who would like to see the actual figures quoted on which it is based. One in particular, who shall be nameless, says "There are only one or two books on the steam engine in our local reference library, and these are much too advanced for the simple beginner, because they assume that the reader has a good knowledge of the subject already. So please keep on explaining the *simpler* things from time to time, so that we tyros do not have to 'keep mum' when fellow club-members are 'talking about steam'." He then goes on to ask how one can calculate the amount of work done in the latter half of the stroke, when the pressure is falling throughout.

Well, let us see how friend Wansbrough does it, but remember that this *is* theoretical.

An Imaginary Portable Engine

First of all, he takes an imaginary portable engine with a piston area of 1 sq. ft.—that is, a bore of something under 7 in.—and a stroke of 12 in., with a speed of 100 r.p.m.

This engine would use 2 cu. ft. of steam per revolution, or 12,000 cu. ft. per hour, working without cut-off. At 45 p.s.i., this quantity of steam (and consequently of the water from which it is produced) would weigh 1,710 lb., and to evaporate that weight of water would require one-tenth the same weight of coal, or 171 lb. In a ten-hour day, then, the engine would use about 15 cwt. of coal.

Cutting-off at Half-stroke

But when working at 55 p.s.i., and cutting-off at half-stroke, the pressure during the whole stroke would be the *average* of the pressures taken at equal intervals of the stroke—say, every inch, and follows the table above:—

Neglecting the decimals, we have the same *average* pressure as before, and, therefore, the same work done, by using *half* a cylinderful of steam per stroke, but using it expansively.

Now the quantity of steam used per hour is 6,000 cu. ft., and at 55 p.s.i. this would weigh 989 lb. To evaporate this quantity of water would

Pressures per Sq. In.

At the end of the 1st inch ..		=	55 lb.
At the end of the 2nd inch ..		=	55 lb.
At the end of the 3rd inch ..		=	55 lb.
At the end of the 4th inch ..		=	55 lb.
At the end of the 5th inch ..		=	55 lb.
At the end of the 6th inch ..		=	55 lb.
At the end of the 7th inch ..	6/7ths of 55	=	47.14 lb.
At the end of the 8th inch ..	6/8ths of 55	=	41.25 lb.
At the end of the 9th inch ..	6/9ths of 55	=	36.66 lb.
At the end of the 10th inch ..	6/10ths of 55	=	33.00 lb.
At the end of the 11th inch ..	6/11ths of 55	=	30.00 lb.
At the end of the 12th inch ..	6/12ths of 55	=	27.50 lb.
Sum of pressures ..		=	545.55 lb.
Average pressure (545.55 ÷ 12)		=	45.42 lb.

use, say, 99 lb. of coal, or in a ten-hour day about 8 cwt.

Thus the saving effected is 7/15ths, or nearly half, in coal, and in water, too.

As Wansbrough points out, this is on paper: the actual saving is less because of a variety of causes which need not be discussed here.

It will be noticed that the pressure falls during expansion in exactly inverse ratio to the increasing volume: for example, at the twelfth inch the space occupied by the steam has doubled and the pressure halved.

I hope the above will answer my correspondents, and be of interest to other tyros, too.

A Horizontal Winding-engine

Another correspondent asks if I will publish an illustration, with drawings if possible, of a winding-engine—"not" he says "the large type as used in big collieries, but the small type as used in quarries, small footrill pits, and similar locations."

Well, I'm sorry I cannot oblige with the drawings, but here is a photograph of a small

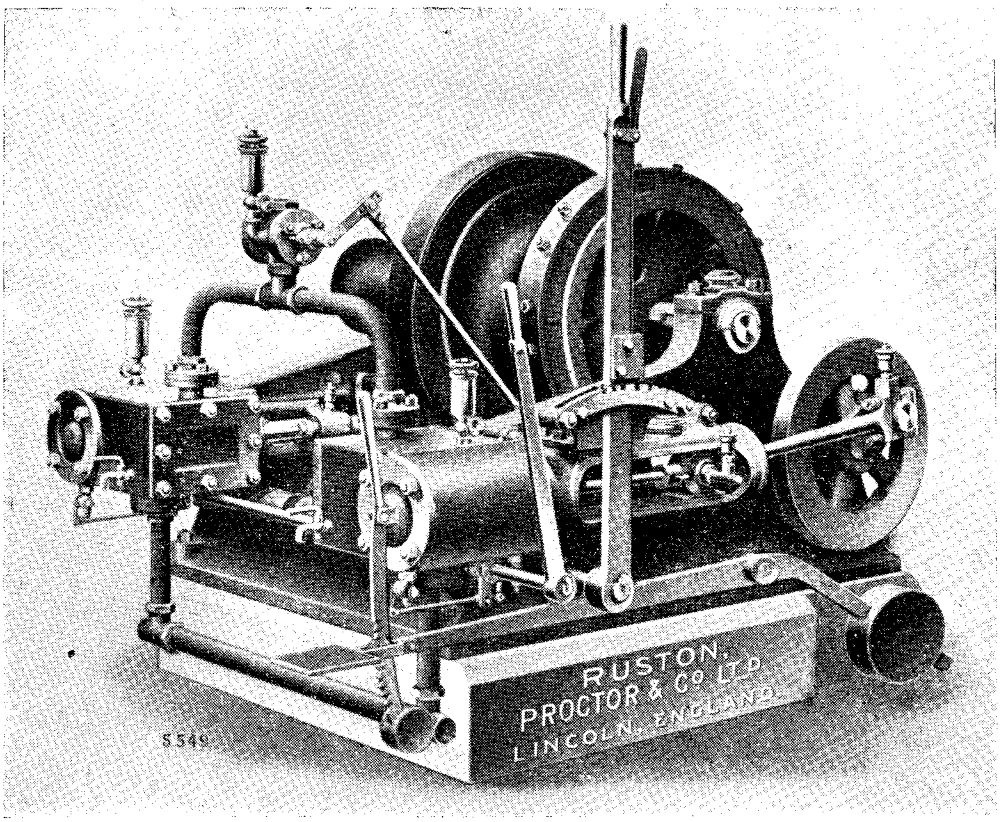


Photo by courtesy] [*Ruston & Hornsby Ltd.*

Photograph No. 11. *A small winding-engine built by Ruston Proctor & Co. Ltd. early in the century, and typical of the many thousands which used to work in quarries and small mines*

Ruston Proctor winding-engine which should be of interest to him and to others. (Incidentally, if any reader has in his possession drawings of a similar engine, I would be very grateful for the loan of them for a period.)

It will be seen that the engine is indeed of small dimensions, because the cylinder cover has only four studs to secure it—little things like that can tell quite a story. Probably the bore and stroke are in the region of 4 in. × 6 in.

The foundation of the engine is a heavy cast bed-plate which incorporates the bearing-brackets for the crankshaft and the drum-shaft. Each trunk-guide is cast in one with its cylinder, and is bolted to the vertical web of the bed-plate, so that the cylinder and valve-chest are overhung.

Marine-type big-ends bear on crankpins fitted to spoked "discs," which have heavy rims to act as flywheels. For quick reversing, Stephenson link-motion is used, the valve-gear being inside the webs of the foundation. The reversing-lever works in a quadrant bolted to the top of the right-hand trunk-guide. Valve-rods are guided by slides which work in brackets bolted to the front face of the valve-chests.

The Winding-gear

The winding-drum itself is driven by reduction-gearing from the crankshaft, the teeth of the spur-wheel being shrouded on the inside edge so that the winding-rope cannot be caught. A metal guard also covers the outer face of the teeth, and a winding-bollard is keyed to the extended left-hand outer end of the drum-shaft. (In some similar engines a bollard was fitted at both ends of the shaft, by the way.)

Cast on the right-hand end of the winding-drum is a brake-drum, and the wooden brake-blocks are bolted to a steel band encircling the drum. The brake is applied, of course, by the foot-operated lever below the reversing lever, and is held in the "on" position by the weighted ratchet-lever hung from brackets cast on the right-hand back cylinder-cover. When the ratchet is released, the brake is returned to the "off" position by the counter-poise weight below the crank-disc.

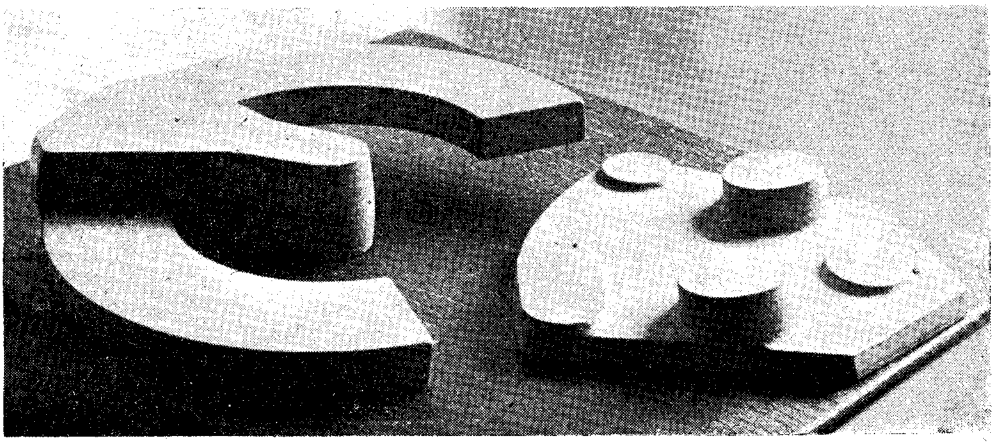
Also incorporated in the brake-gear is a trip device which closes the regulator when the brake is applied, if the driver has not already done so. The rod which works the regulator may be seen,

(*Continued on page* 379)

A TWIST DRILL POINT GRINDING JIG

by W. D. ARNOT

THE general arrangement drawings—plan and elevation (Fig. 6), show the result to be arrived at. These are to scale except in minor details, and as none of the proportions are hard and fast but may be varied within the limits of the castings and operating requirements, dimensions are not shown, as they would confuse the construction, but some will be mentioned here and there in describing machining. My castings are in aluminium, and I find this a pleasant metal to work and convenient to procure. Should rapid wear be feared in service, there is but one location in which this might be expected, that is the arbor bore. There is room here to fit a liner of other metal, for those who judge it necessary. Should anyone like castings made, my patterns are at their service and the local foundry has given me a nice sound job. Aluminium has recently risen in price, but I had figured that the cost would be within twenty shillings, and I think it still will be; only the two castings are required. The patterns are seen in Photograph No. 4.



Photograph No. 4. Patterns for the final jig

Before describing construction, I must mention the chuck. A No. 1A Jacobs is shown, capacity 0-¼ in., bored through 7/32 in. It has many advantages—wide range of capacity, accuracy, compactness, speed in adjustment. Yet it would be better to provide a collet chuck because the three jaws do not bear on the helical lands of a drill throughout, but each at isolated points. A range of collets would be very costly—I am quoted 8s. 6d. each in lots of three or more—but for those who could consider that expense for a limited range or would care to make them, I would suggest building to take the standard Crawford collet made for Pultra lathes; this is listed with body diameter 10 mm. and through-bore capacity up to allowable wall thickness inside a 0.389 in. diameter thread. Mr. Stuart W. Blackley describes the kind of thing to make in the issue for May 15th, 1952. Failing that, sleeves can be made for the smaller drills to be held in the Jacobs or similar chuck. They will need to be precisely concentric throughout their length, preferably split into three most of their length.

Now to the machining of the castings.

Swing Block and Sectors

Block and sectors are cast as one piece so that the ball-ways may be cut to correspond with one another exactly. Check one side of the casting for flatness and if any rock is found, packing may be used or the casting levelled by filing. There is plenty of excess metal, and I used packing of shimstock, clamping the job to the faceplate with two bolts and clamps by one sector wing as seen in photograph No. 5., which shows the first side machined. The limb projecting to the centre is a tooling provision only, to be cut away later. A centre was scribed on it central to the wings and centre-punched. The tailstock centre was then brought up to the punch mark and the casting tapped into central position on the faceplate before final tightening up. The counter-weight seen did not give perfect balance, and should have been heavier, but there was nothing flat enough handy. Vibration was not excessive.

A facing cut is taken, and when the face is level the punch mark is opened up by combination centre drill, then drilled through with a

Continued from page 356, " *M.E.*," *September* 11, 1952.

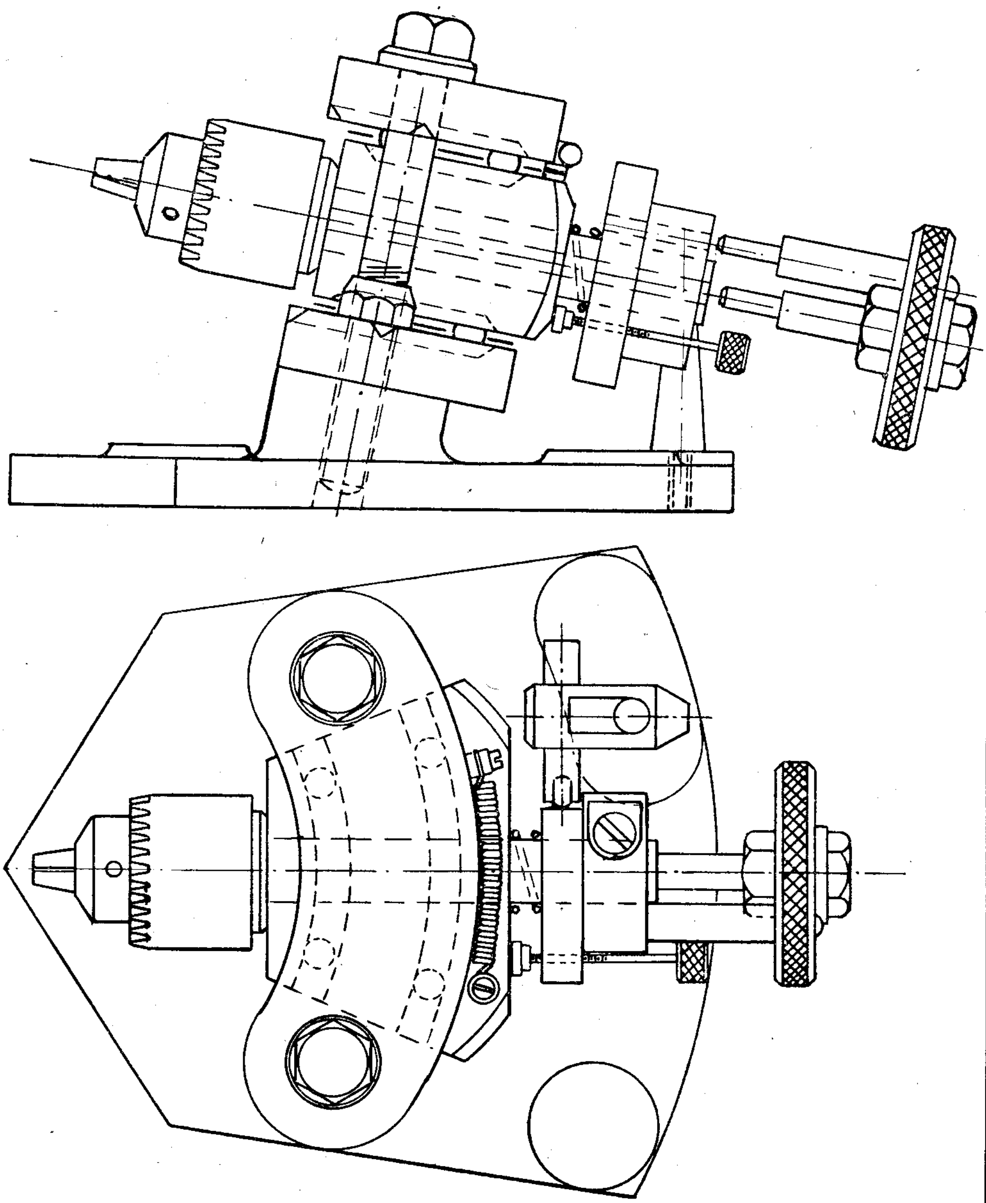


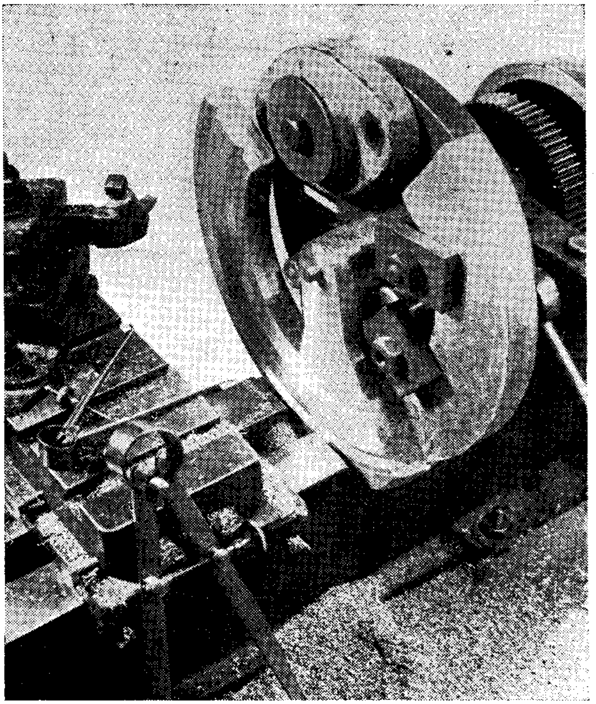
Fig. 6. General arrangement, elevation and plan

¼-in. drill. This gives a means of centring the other side exactly to correspond. When clean facing all over is obtained, circles are scribed with the tool point to represent the central width of the sectors and their outer and inner edges, to be machined down to later after separating from the block. Further circles are scribed representing the centre of the ball groove vees.

It is now best to make a gauge from sheet as shown in Fig. 7, the hole being ¼ in. to slip on a ¼-in. pin placed in the centre tooling hole and the projections at the positions of the grooves, to finished dimension, bent over to enter them when cut.

The top-slide is now set over at 45 deg. first one way, then the other, to machine into the

scribed groove centre-lines, gradually bringing to depth, with a constant check against the gauge to ensure that position is being held. The depth of grooves should be exactly identical, but it is sufficient to bring them within a few thousandths of one another. A refinement some may care to adopt would be to provide the upper sector, when finished, with ball seats where the bolt passes through and use a ball-faced washer beneath the bolt head; that would allow the top sector to compensate any slight error in equality of groove depth, but I have not found that really necessary.



Photograph No. 5. First grooves completed

Having machined one side as seen in the photograph, the casting is released, turned over, centred from the $\frac{1}{4}$ in. pin, secured and the procedure repeated for the reverse face. The sectors have been so arranged on the casting that the interrupted cut strikes the solidly bedded block and not the overhung sector, which might vibrate but will not do so on a trailing cut.

As regards equal groove depth, this can be checked to a high degree of precision quite simply. A $\frac{1}{4}$-in. ball is placed in each groove in radial alignment and held there by a piece of flat plate across them. A piece of tapered material is then used as a feeler first one end, then the other to check whether the plate is held equi-distant from the face by the balls. By careful work this plate can be brought exactly parallel, although the groove centre-lines may alter position in doing so. That is not significant, since matching grooves still correspond with one another and the centres of their circles of track remain the same and identical.

Before releasing the casting, the approximate centre-line down the taper block-piece is found and, with the tool on true centre height in the toolpost, a line is scribed by operating the cross-slide, marking the block down to the centre. Also, an approximate centre-line radially is found for the sectors and scribed similarly. The casting may now be released. Before the sectors are cut away from the block, a letter is stamped on each face "T" and "B" to show mating block and sector faces.

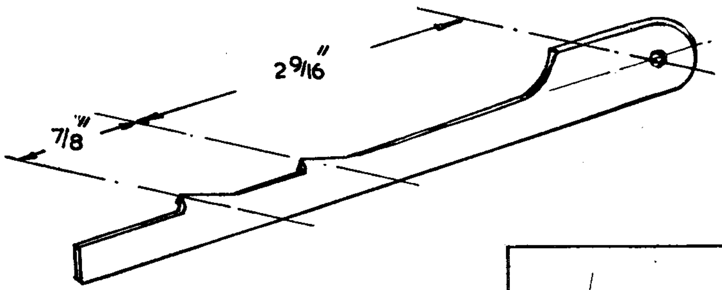
It should be said with regard to the 90 deg. groove form, this is theoretically not corect for skid-free action, but it is adequate practically. For those who would have perfection, Fig. 8 shows the grooves that should be cut, the lines from the centre of swing, striking out conical surfaces always centred on the same lateral central axis. It implies the use of differing ball diameters for inner and outer track; $\frac{1}{4}$ in. and $\frac{3}{16}$ in. would work, but spacing acuracy between grooves would be critical and is found by trigonometry to be an odd measurement not easy to check with normal tools.

Sector Finishing

The sectors are now cut off by hacksaw, close to the block. They have been allowed plenty of length in the pattern so that there is room to drill holes beyond the ends of the finished sectors, for fastening to the faceplate to machine the reverse side; again not an essential operation, for spotfacing at the bolt holes would do, but all-over facing gives a good appearance and does not take long. My method was to drill and countersink the ends for wood screws and fasten to a $\frac{3}{4}$-in. plywood disc secured to the faceplate. Inner and outer diameters were first scribed on the plywood and by registering the circles already on the sectors, cut when still attached to the block, these can be mounted at opposite diameters of the faceplate, concentric with one another. They are faced down to thickness and finished to outer and inner diameter.

The sectors are now taken off the faceplate, the radial centre-line scribed across one of them in the grooving operation is transferred to the other by matching them together and scribing across. One of them is now centre-popped at the intersection of centre-lines, and with this as a centre, dividers are set to $1\frac{9}{16}$ in. to scribe the bolt holes. This will space them at 3 in. centres, corresponding to the bosses on the baseplate. These 3 in. centres are centre punched heavily on one sector only, and lightly on the other from which to scribe the end profile. A $\frac{3}{8}$-in. drill is put through one end only of the heavily punched sector. If there is vibration or slackness in the drilling machine, hesitant drilling will allow drift of the hole to develop in this soft metal, but steady follow-

through pressure will give a clean hole in position. The drilling can, of course, be done in the lathe against a tailstock pad. Next, four $\frac{3}{16}$-in. steel balls are set, one in each extremity of the grooves and the sectors mated together with the radial centre-lines in alignment. In that position they regard these files as indispensable for cast aluminium, and for cast brass and bronze. Using normal files, I tried the usual suggestion of chalking the file and the work, but found it quite ineffective. Having read that grinding wheels for soft metals are impregnated with



Left—Fig. 7. Groove-cutting gauge

are securely clamped together at the ends where the balls are. The balls are in the portions of the grooves which will be cut away when rounding the ends, so that should clamping pressure indent them, there is no damage to the service portion of the grooves. It will be found that $\frac{3}{16}$-in. balls allow the paired sectors to all but close together if groove machining has been kept to about $\frac{1}{8}$ in. apex depth off each face.

With the sectors so clamped, the drilled bolt hole is now carried through the other sector, a bolt put in to hold the register and the other end drilled right through. There remains only the end trimming. Hacksaw and file are used. I find cast aluminium troublesome to finish by file, and the coarsest file usually gives a much better finish than fine ones because they "pick up" so. Which reminds me that I do not recall any reference in THE MODEL ENGINEER to "Dreadnaught" or "Millenicut" files. These are milled tooth files, usually with crescent shaped teeth, appearing extremely coarse to look at, but applied with controlled pressure they cut a perfectly smooth surface. Even they will "pick up" in the course of time but are cleaned with a wire brush easily, while an old scriber is required to remove it from normal files. I

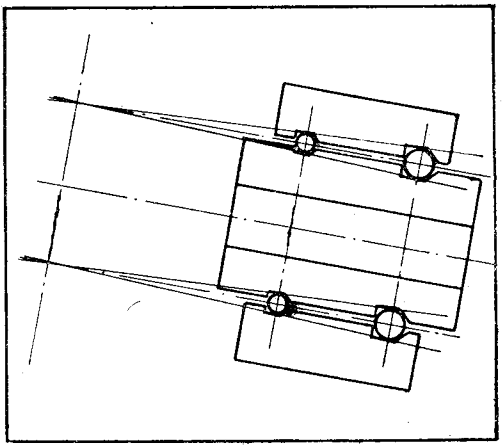


Fig. 8. Grooving refinement

resin or paraffin wax to prevent "loading," I tried rubbing a candle over the files. That was a great improvement over chalk, but not to compare with the "Dreadnaught" file.

(To be continued)

"Talking about Steam——"

(Continued from page 375)

but unfortunately the operating part of the device is concealed. It should not be too difficult, however, to work out a simple arrangement which would do the necessary, though if any reader has the *authentic* information on this, I'd be pleased to hear from him.

Another point to note is the lever which operates the drain cocks. It is keyed to a shaft carried in brackets attached below the valve-chests, and operates the coupled cocks through short slotted levers.

Incidentally, some months ago I was gratified to see an engine very similar to this as the power-unit for a dragline. The latter was mounted on a low-loader, in transit from one opencast coal-mining site to another, which is quite a common sight in Yorkshire, but this was the first and only steam-driven dragline I had seen, either working or in transit.

Unfortunately, however, it was after nightfall when I saw the engine, so that a detailed inspection was impossible, and, of course, photography was out of the question. The vehicle was parked at the side of the road, surrounded by red hurricane lamps, but next morning it had gone before I arrived on the scene, worse luck. Still, it is good to know that steam is still working in this sphere, even if this is only an isolated example. One thing is sure—there'll be no fuel problem for that particular operator!

THE MECHANICS OF RADIO CONTROL

by Raymond F. Stock

A BRIDGE-PIECE was then fitted across the top of the two aluminium pillars and supported a worm-driven toothed quadrant which carried two contact plates. These were arc-shaped, of tin plate riveted to a paxolin strip, and were arranged to lie just below a light bronze wiper on the end of the needle. Fig. 26 shows this assembly, and in the side elevation indicates the relative positions of the wiper and the two contact strips. It will be seen that the wiper does not actually contact the strips but picks up its current from the two blobs of mercury which are retained in position by surface tension and the affinity of the mercury for tinplate. This arrangement ensures that the follow-up mechanism imposes the least possible loading on the balancing movement. Fig. 27 shows the circuit; the steering linkage picks up on a crankpin mounted on the toothed quadrant.

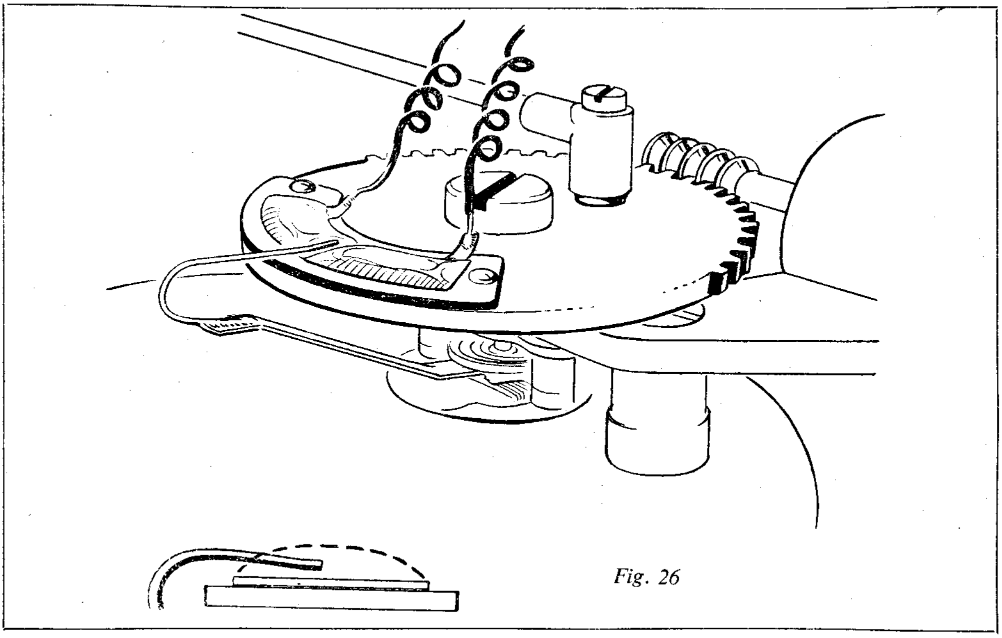


Fig. 26

Electromagnets

The preceding examples will, it is hoped, give an idea of some of the ways in which simple components may be combined to effect different results. All such systems depend at some point upon the employment of electromagnets, if only in the form of a relay. These are simple devices but often seem to cause difficulty, particularly with regard to the size of wire and number of turns employed.

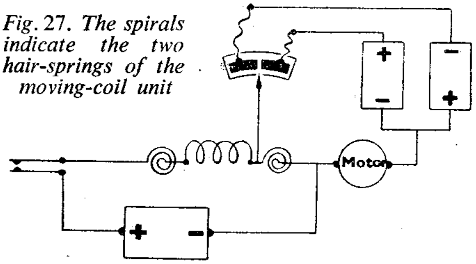
Assuming that the necessary formulae are available, design is often difficult because the end result in terms of force is not known. Fortunately commonsense dictates roughly the overall size of the unit, and below a certain maximum the power output can be accurately adjusted by varying the applied voltage.

Fig. 28 shows a form of construction suitable to any electromagnet referred to in these notes. **A**, the core, is turned from soft or wrought-iron to the proportions shown, and shouldered down to a neat press fit into the yoke **B** where it is retained by a steel screw or bolt. The yoke should be of the same material as the core; mild-steel may be used if nothing better is available, but harder alloy steels are to be avoided. The armature **C** may be mounted on an adjacent pivoted part of the unit (such as in an escapement); if it is directly pivoted to the end of the yoke it should be pinned between lugs to form a hinge, as shown in Fig. 28. This drawing also illustrates the extension **D** which, by means of its adjusting screw and lock-nut, forms an adjustable stop for the armature in its "open" position. When closed, the position of the armature is limited by the end of the core; a small brass rivet standing above the iron surface by about 10 thou. is inserted through the armature and prevents an iron to iron contact between the two parts; this obviates any tendency for the armature to "stick" and speeds up operation.

The dotted lines in Fig. 28 indicate the overall diameter of the winding, irrespective of the

Continued from page 347, "*M.E.*," *September* 11, 1952.

Fig. 27. The spirals indicate the two hair-springs of the moving-coil unit



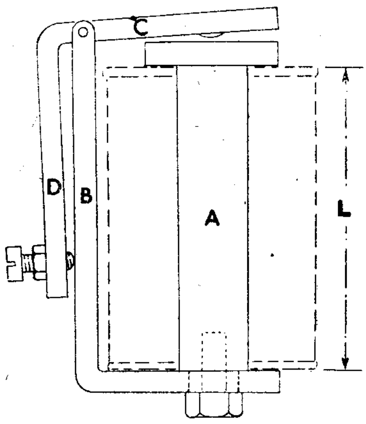


Fig. 28. Suitable proportions for an electromagnet. For most purposes, the length "L" will vary from 1 in. to 3 in.

wire gauge used; the actual gauge and the number of turns are, of course, complementary. The pull obtained from an electromagnet varies with the input in watts; i.e. voltage applied × current used. This last factor is generally the limiting one in models, since the watts available from a battery depend entirely upon its weight and bulk. The design of a practical electromagnet for use in models, therefore, amounts to (*a*) deciding on the size of battery to be used; (*b*) deciding the maximum current drain permissible and (*c*) calculating the size of wire to ensure (*b*). The latter is done by trial and error, using wire tables of which the following is an extract :—

Wire gauge (enamelled)..	22	24	26	28	30	32	34	36	38	40
No. of turns per in. ..	33	42	51	62	74	85	100	120	150	188
Resistance in ohms per yd.	0.039	0.063	0.094	0.140	0.200	0.262	0.361	0.529	0.849	1.327

From the above table the "turns per inch" row enables one to calculate the number of turns in the complete coil. The actual number is likely to be not more than 90 per cent. of this figure, depending on how neatly the wire is laid on. The length of wire required can then be calculated by multiplying number of turns by average length of a turn (i.e. length of a turn halfway between inner and outer layers of the coil). This overall length, in yards, can then be converted to resistance in ohms by using the third row in the table.

Ohms law stating that $I = \frac{E}{R}$ can then be used to determine the current drain.

Example :

Winding space of coil = 2 in. long by 1/3 in. thick. Assuming the use of 34 gauge wire,

2 × 100 turns can be wound per layer and
1/3 × 100 layers can be accommodated =
200 × 33 = 6,600 turns.

If the coil conforms to the conditions shown in Fig. 28 the average diameter of a turn will be 2/3 in.

= length of 2 1/10 in. app.

Total length of wire then equals 6,600 × 2 1/10 in.
= 13,860 in. or 385 yd.

34-gauge wire has a resistance of 0.361 ohms/yards, so total resistance = 385 × 0.361 ohms.
= 140 ohms app.

If two grid-bias type dry batteries were to be used for a power supply, voltage (**E**) = 18.

Substituting in Ohms law we find the current drain to be :—

$I = \frac{18}{140}$ = 0.128 A or 128 MA, which is well within the capacity of this type of battery, even for continuous use. When current is used in pulses, as it usually is in electromagnets it is possible to use about $\frac{3}{4}$ A from cells of the size mentioned (i.e. grid bias batteries, 4.5 flash lamp batteries, No. 8 cells, etc.). The capacity to provide a given current depends, of course, on the size of the cell and has no connection with the *number* of cells in series (which determines the voltage).

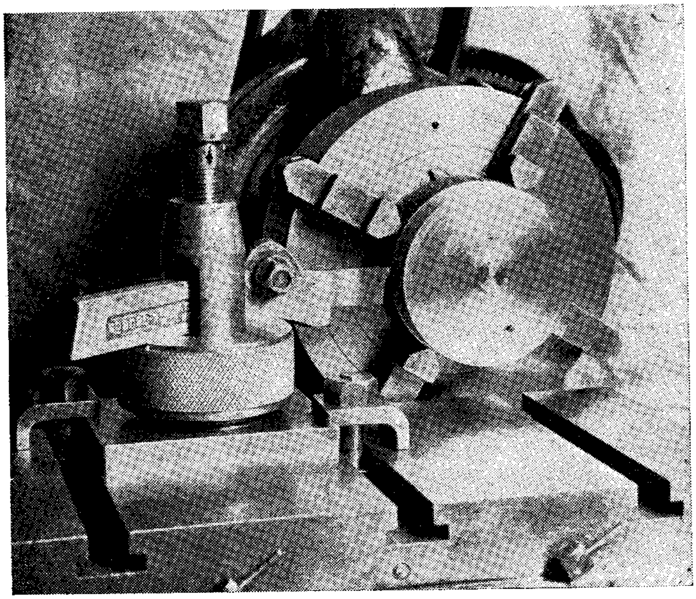
In the foregoing example the coil would be rather under-run, but to increase the current to say, 1 A, would require a large number of cells. This indicates that a thicker wire would be more suitable for most purposes, and one might try 28-gauge which works out to a consumption of 0.86 A at 18 V, an input of $15\frac{1}{2}$ W; the former winding uses 18 × 0.128 = 2.3 W.

For a lower voltage battery one might use 22-gauge wire which would have a resistance of 1.6 ohms and thus use nearly 1 A from a single cell, or about 2 A from a 3 V cycle lamp battery.

The above examples may serve to give an idea of the way that the wire gauge and number of turns are related to the voltage; to sum up, one may say that the design of a winding is never critical, since given an approximately correct size for the magnet frame (erring on the large size when in doubt) the actual power may be adjusted to suit the purpose by varying the voltage applied.

Notes on Parting Tools

by J. Latta



"One of the big jobs"

SINCE THE MODEL ENGINEER was first published more than half a century ago a very great deal must have been written in its pages on the use of the parting tool in the lathe; but he would be indeed a bold manwho would assert that the last has been said on this subject, or that the way is now easy for the tyro, provided he follows the instructions that have been so often given.

The purpose of these notes is not to give infallible instructions on how the job should be done, but to point out the limitations of small lathes and tools, and in particular, to describe what I believe is a novelty, and which gives more than the usual chance of success in what is admittedly a rather slow and uncertain operation at the best of times.

The plain fact of the matter is, that parting off in a small lathe will always be a tricky job, and more especially if the tool has to go in to any considerable depth.

The writer, who can claim a long and varied professional experience with all kinds of lathes both large and small, has no hesitation in saying that this problem only becomes a real problem, when the lathe is small and light, and the job just a bit too big for the machine; unfortunately, these seem to be almost normal conditions for most model engineers.

I Knew All?

During my apprenticeship days, I can well remember being given the job of parting off a number of sizable chunks of cast-iron on a lathe of 8 in. centres or thereabouts. The machine was not in its first youth, needless to say, or an apprentice would not have been put on to it; nevertheless, I was delighted to find after a little instruction from the "gaffer" that I could slice off those pieces in quick time with no bother at all; and I rashly concluded that I knew all there was to know about parting off.

On returning home during a holiday period, I confidently attempted a little parting off job on my 3½-in. Drummond, and after several severe "digs in" and a smashed tool, I sadly realised that I still had something to learn. That was about 40 years ago; I have accumulated a lot of experience since, but am still learning.

Those of us who have seen the effortless way in which quite deep parting cuts are taken on capstans and automatics on production work, may be forgiven for thinking that the same operation ought to be possible on a small lathe, provided some genius would grind and set our tool for us.

Nevertheless, it is as well to realise that the difficulties increase out of all proportion when using a small and light machine, even if it is in perfect condition as regards the fit of the bearings and slides, and all the other points that are stressed in "the book of words."

The Trouble Starts

In the normal way there should be no great difficulty in parting off the usual run of small stuff, such as bolts or pins and the like, with diameters up to about ⅝ in. It is when the bigger jobs are encountered, such as cutting the fins of a petrol engine cylinder from the solid, or slicing off a piece of 2 in. diameter mild-steel, that the real trouble starts.

In general, cast-iron and the softer metals give less trouble than steel or hard bronze, but deep cuts are always difficult on a small lathe.

At the risk of repeating what has been said many times before, it may be as well to go over the more obvious pitfalls in the making and setting up of a parting tool.

To begin with, the tool is inherently weak due to the fact that the rear portion cannot be wider than the cutting edge, and if we use a wider cutting edge in order to get a stiffer tool, the width of the shaving may be greater than the lathe can cope with safely unless the feed-in is reduced to the point where chatter starts, so the first rule

should be to keep the width as small as possible.

This width will vary according to the depth the tool will have to go into the work, but for a small lathe of about $3\frac{1}{2}$ in. centres, there is not much latitude; the upper limit for width being about 3/32 in.-7/64 in. depending on the stiffness of the machine. Below about $\frac{1}{16}$ in. the tool becomes rather frail unless it is short. A reasonable compromise would be $\frac{1}{16}$ in.-5/64 in. wide for a short tool suitable for work up to $\frac{5}{8}$ in. diameter; and for a longer tool with which you may hope to make cuts up to $1\frac{1}{2}$ in. deep, the point width could be up to the maximum of 3/32 in.-7/64 in.

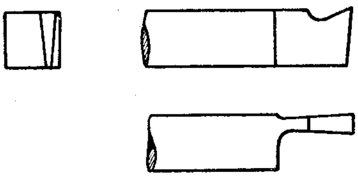


Fig. 1

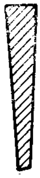


Fig. 2

These figures are given as a general guide only, and one must be prepared for some trial and error with individual lathes, but it is a good fault to err on the narrow side.

The next thing to be sure of is that there is clearance from the cutting edge all ways, both backwards along the tool, and downwards from the point; otherwise it will jam in the cut after it has entered some distance.

Lastly, the tool should be as deep as possible so as to get all possible stiffness in spite of the narrow width, and this is often difficult to arrange for in a small lathe unless something special in the way of a tool holder is contrived.

Operating Precautions

In addition, there are the usual operating precautions which most of us know by heart; a slow but deliberate feed, modest cutting speed, ample lubrication for steel, and so on.

A tip which has often been given, is to use the tool upside down at the back; and this, in my experience, helps quite a lot, the reason usually quoted being that the lathe spindle is pressed down on to the bottom half of the front bearing, instead of being lifted up.

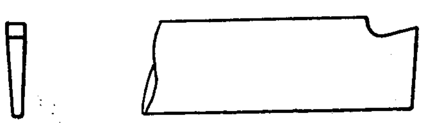


Fig. 3

This may or may not be the answer; personally, I am inclined to give some credit to the fact that the chips tend to fall away, instead of piling up on the tool and perhaps causing a jam; also, if the groove is less obstructed by cuttings, it is easier for the lubricant to get right down to the bottom.

This last is quite a problem with deep cuts; even the most copious supply has difficulty in getting to the place where it is going to do the most good.

Fig. 1 shows the usual shape of a small parting tool which may be ground from a piece of tool steel.

It will be noticed that the necessary clearance is given by grinding the tool with tapered sides both in plan and elevation.

This is quite satisfactory for a short tool, but, if a long tool for deeper cutting is made on these lines, it is obvious that the angle of the taper on the sides must be considerably reduced, or else the root of the blade becomes impossibly thin and weak just at the very place were we need the greatest strength.

If the side taper is made too slight, very little wear on the point will eliminate the clearance there altogether and the tool will tend to jam. Farther back the clearance is much greater than is necessary and cuttings may work their way down the side of the tool and also cause trouble.

A Deep-cutting Weapon

The most satisfactory weapon for a really deep cut is the Armstrong pattern holder which uses a deep high-speed steel blade ground parallel throughout to a section similar to that shown in Fig. 2. The blade is clamped in the groove in the holder, and can be moved in or out, so that the amount of blade projecting is just sufficient for the job in hand, thus avoiding excessive overhang.

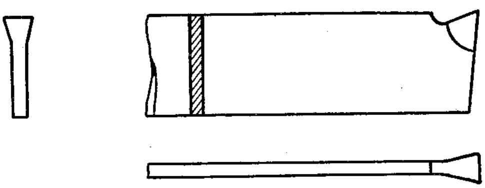


Fig. 4

When carefully set up, these tools can be made to do excellent work, but they have their limitations. It is very necessary to set them up exactly square to the line of the centres, as owing to the fact that the section is parallel over the whole length of the blade, a certain amount of unavoidable rubbing on the sides of the cut takes place all along the top of the tool, and if the point is the least bit dull, or the tool not set square, the friction will cause trouble.

Also, as the tool is arranged in the holder, there is practically no top rake, so that steel can only be cut with copious lubrication.

Do not be tempted to grind a small lip at the end as in Fig. 3 so as to give a bit of rake, or there is sure to be trouble as soon as the tool enters the work past the full extent of this lip.

The reason for this is not far to seek. Very little grinding of the front edge will bring the cutting edge lower than the top of the rest of the blade; and owing to the taper section it will then cut a groove slightly narrower than the width of the blade behind the lip, with dire results.

The ideal tool for a deep cut would be shaped as in Fig. 4. Here we have a tool with a rectangular section blade just wide enough to give clearance at the sides, the cutting tip being a slightly wider portion at the end, merging into the parallel shank with a slight taper all ways to give clearance to the cutting edge; but it is easy to see that grinding up such a tool would be a bit of a problem.

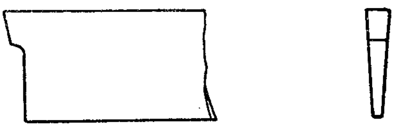


Fig. 5

However, it is quite possible to get this shape by upsetting or "bumping up" the tip while hot, and as I have used tools made in this way with every success for some time, I think the method is worth describing in detail.

The high speed steel Armstrong blades are quite easily modified in this way, but any thin section tool steel such as ground flat stock can be used if desired, if a carbon steel tool is not objected to.

The end of the blade is first ground to the shape shown in Fig. 5. The projecting nib provides the metal for the upset, so this must be at the thickest edge if an Armstrong blade is used.

Hold the blade in the vice with the nib end projecting about $\frac{3}{4}$ in. above the jaws.

Heating

This is best done with an oxy-acetylene blowpipe using a tip about a size smaller than would be correct for welding the same section of steel. Do not have too big or fierce a flame, and use the blue part only for heating the nib on the blade and try to heat evenly by keeping the blowpipe on the move all the time.

As soon as the end is red, begin a series of very gentle taps on the end of the nib, keeping the face of the hammer as square to the axis of the blade as you can. The hammer should be a light one of about 3 or 4 ozs, and about 20 gentle taps may be needed to form the end. Work with the blowpipe in one hand, and the hammer in the other, so that the heat is kept on the job all the time.

The best temperature is a good bright red, and be very careful not to over heat, or the steel will be burnt at the fine edges. Examine your finished effort under a glass and the result should look like Fig. 6.

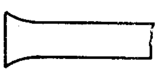


Fig. 6

The effect of too heavy a hammer blow or not enough of them generally comes out as in Fig. 7.

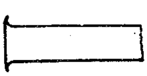


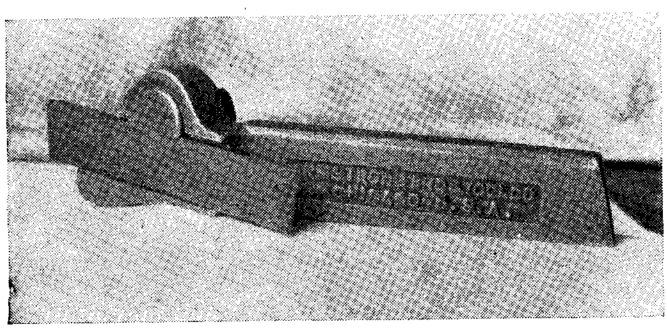
Fig. 7

I have not tried a blow-lamp for the job but I daresay it could be managed with a little care.

Do not endeavour to get a wide upset on the end, quite a small amount is sufficient to give all the clearance needed, about 0.010 in. wider than the blade is about the amount to aim for, as the sides need not be ground, in fact it would be almost impossible to do so.

All that is then necessary is to grind the front edge, and form a small lip on the top to give any necessary top rake.

High speed steel being self-hardening will be found to stand up quite well without further treatment, but if a carbon tool steel is used, the point will have to be hardened and tempered in the usual way If not successful in making a neat upset at the first attempt, do not try to rectify it by further hammering or heating. It is better to grind a fresh nib on the end and have another shot at it.



Armstrong parting-tool holder and blade

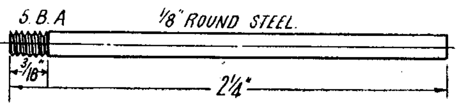
The natural curve of the upset from the front edge forms a perfect curved clearance and wear on the sides does little harm. An occasional rub with a hone on the front edge will keep the tool in condition for a long time.

A tool made on these lines will work well even when cutting very deeply; but always remember that there are limits to what a small lathe will do; so, don't stick out your neck, or your parting tool too far, or you may regret it.

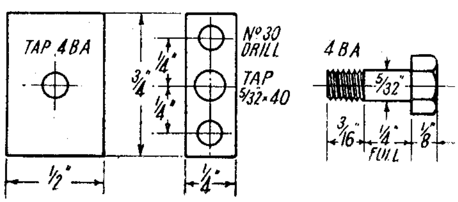
The "Canterbury Lamb" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

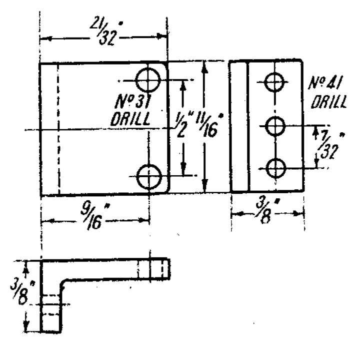
ONE great advantage of a job of this sort is that you can get on with it. You don't have to spend hours and hours on making intricate parts, and putting a posh finish on them. "Mikes" were unknown in the shops where the old girl herself was built—if they got within $\frac{1}{16}$ in., it was good going—there were no slide-rules in the drawing offices, and they didn't even have a typewriter to use for making out the bill. I don't for one minute suggest that builders should make a rough job of the little engine, but there is no need to put on her the sort of finish beloved of exhibitions; merely ordinary "machine-finish" will be just right.



Guide bar



Crosshead and pin



Guide bar bracket

Well, to proceed with the business, the next item will be guide bars, and they aren't quite as elaborate as those I specified for *Britannia*. Cut four pieces of $\frac{1}{8}$ in. round steel, each $2\frac{1}{4}$ in. long, chuck each in three-jaw, and put $\frac{3}{16}$ in. of 5-B.A. thread on one end, to match the tapped holes in the bosses on the back cylinder covers. You can use silver-steel, or mild-steel, whatever happens to be handy. Don't screw them into the cylinder covers yet.

The crossheads are plain blocks of steel or bronze. If you have a piece of bar, of $\frac{1}{2}$ in. × $\frac{1}{4}$ in. section, chuck it in the four-jaw, and part off two $\frac{3}{4}$ in. lengths. Alternatively, they can be sawn off to full length, and faced off to dead length by chucking in four-jaw and taking a skim off each end. Mark off one end as shown in the illustration. If you have a bench drilling machine, grip the embryo crosshead in the machine vice, marked side up, and level with the tops of vice jaws. Drill all the three holes with No. 30 drill, the middle one halfway through, and the outer holes right through. Tap the middle one 5/32 in. × 40, using the drilling-machine chuck to guide the tap, in the same way as I have described many times for using the tailstock chuck when tapping in the lathe. The threads must be "spot on," to ensure absolute alignment of piston-rod and crosshead, and free running of the crosshead on the guide bars. You want the power available at the drawbar, and not mopped up in overcoming friction in the engine!

If you have no drilling machine, chuck the crosshead in the four-jaw, with the middle pop mark running truly, and drill and tap it by aid of the tailstock chuck. Then reset so that one of the end pop marks runs truly; centre, and drill right through with No. 30 drill. Reset again with the other pop mark running truly, and ditto repeato operation. Beginners note—it is as easy as eating pie to set a pop mark running truly, if you bring up the tailstock with the centre-point in it to act as guide; merely adjust the chuck jaws to push the work just right for the centre point to enter the pop mark. Any of my girls of the Kaiser's war munition shop could do it quicker than I can write these words. Finally, drill a No. 34 hole squarely through the middle of the crosshead, either by drilling machine, or in the four-jaw, and tap it 4 B.A.

For the pin, chuck a bit of $\frac{5}{16}$-in. hexagon steel rod in three-jaw, turn down $\frac{7}{16}$ in. length to 5/32 in. diameter, further reduce $\frac{3}{16}$ in. of the end to 9/64 in. diameter, and screw 4 B.A. Part off $\frac{1}{8}$ in. from the shoulder, reverse in chuck, and chamfer the corners. A piece of 3/32 in. angle, $\frac{11}{16}$ in. wide on one side and $\frac{3}{8}$ in. on the other, is needed for the brackets. I don't suppose you will get this commercially, but it doesn't matter a bean. Just bend it up in the bench vice, from a strip of 3/32 in. steel, $\frac{11}{16}$ in. wide. The bend need not be too sharp, quite a rounded corner will do, and there will then be no fear of cracking the metal. Alternatively, a piece of commercial angle, $\frac{3}{4}$ in. × 3/32 in. (brass or steel) can be cut down to the given dimensions. Drill it as shown, and

round off the corners. It is important that the two holes for the ends of the bars are set exactly at $\frac{1}{2}$ in. centres, and $\frac{9}{16}$ in. from the bolting flange, to ensure easy running of the crossheads. The crossheads can now be screwed on to the piston-rods, the guide bars poked through the top and bottom holes in the crossheads, and screwed home into the bosses of the back cylinder covers. They should slide up and down quite freely.

Connecting-rods

The connecting-rods are made in a manner similar to the coupling-rods. Two pieces of $\frac{7}{16}$ in. × $\frac{3}{16}$ in. steel bar, or nearest larger, will be required, each about 4 in. long. Centre each end, squaring off either in the chuck or with a file, and mount the rod between the lathe centres, turning the middle part to $\frac{3}{16}$ in. diameter as shown. On the centre line, set out two points $3\frac{1}{16}$ in. apart; drill one $\frac{5}{16}$ in. and the other 7/32 in., then file the ends of the rod to the shape and dimensions shown. Use good hard bronze or gunmetal for the bushes, and turn them to a tight fit in the holes in the connecting-rod; put the reamers through again after the bushes have been squeezed home, using the bench vice as a press. Note that the flange of the big-end bush is on the inner side of the rod, and goes next the wheel boss; this wheeze not only gives $\frac{5}{16}$ in. width of big-end bearing, but allows the cylinders to be spaced out a little farther from the frame, with deeper holes in the bolting faces, and consequently better hold for the fixing screws. If anybody wants to fit a dummy cotter, a feature of these old-fashioned rods, just drill two 3/32-in. holes side by side through the thickness of the rod, run them into one slot with an Abrafile, or any similar spiral-tooth gadget, and file up the cotter from any odd bit of steel, to a drive fit. Alternatively, you could work the "rogue fitter's" trick; drill one hole, tap it, and screw in a shaped piece at top and bottom.

How to Erect the Cylinders

The cylinder-erecting process is carried out much in the same way as the job was described for *Tich*, the only difference being the slope of the cylinders. The scribed line on the frame, showing centre-line of motion, is a good guide; but if the frames were properly cut out, drilled, and erected, the extensions at the top should locate the cylinders practically without the need for a check-up. Set the cylinder against the frame extension; put a big cramp over it, to hold it temporarily in position, then adjust cylinder so that the upper edge of the extension is exactly level with the joint between the steam chest and the cylinder, and the end of the extension exactly flush with the end of the cylinder casting. To check up, all I ever use is a bit of ordinary sewing cotton; in this case, a piece about 6 in. long. Stretch it taut, and lay one end along the piston-rod, same being pulled out as far as possible. The other end of the cotton should pass exactly above the centre of the driving axle, with the axleboxes at their running position in the hornblocks.

If all O.K. tighten the cramp, and proceed to locate the screwholes on the bolting face of cylinder. I don't suppose you'll have a No. 30 drill 4 in. long—though they *are* made commercially, for special jobs; I've got one—so the best thing to do, is to lengthen an ordinary No. 30 drill by brazing a bit of $\frac{1}{4}$-in steel rod to the shank. I've lengthened various drills in this way, by filing a step on both shank of drill and bit of steel, putting the steps together to form a zig-zag joint, and giving same a spot of Sifbronze. Alternatively, you could file an arrow head on the end of a bit of $\frac{1}{8}$-in. silver-steel about 4 in. long, and harden and temper it. Put the drill, or the substitute, in the hand brace, and poke it through the holes in both frames, making countersinks on the bolting face. Remove cylinder, temporarily erect the other in position, same as the first, and ditto repeato the countersinking operation. Then drill the countersinks with No. 40 drill, and tap $\frac{1}{8}$ in. or 5 B.A.

Double warning: don't pierce the bores, or you've had it; also make certain that the holes are at right-angles to the bolting face, or the cylinders will work loose. The way I make certain of this is to take off the steam chests and hold the cylinders in the drilling-machine vice, with the port face against one of the vice jaws, a piece of smooth soft metal being placed between port-face and jaw for protection of the former. Then the bolt holes can't help being square with the bolting face; and there is no chance of piercing the bore, if the stop on the drilling-machine spindle is set correctly before drilling.

After tapping, smooth off any burrs, and temporarily erect the cylinders with about three screws in each; then attach the guide bar brackets. Pull the piston-rod out of the cylinder as far as possible, and put the bracket over the ends of the bars, with the narrower side against frame, and pointing to the rear. Put a toolmaker's cramp over bracket and frame to hold it in position; then work piston-rod up and down, to make sure there are no tight places. If the rod goes hard, or binds, adjust bracket until the rod slides freely, indicating that the bars are parallel with it, and not gripping the crosshead at any point; then make countersinks on the frame with a No. 41 drill through the holes in the bracket, drill No. 48, tap 3/32 in. or 7 B.A., and put screws in.

Put the connecting-rods on, and put each crank in turn, on front dead centre, with the crosshead as near the cylinder as it will go. Take out the crosshead pin, and see if the piston-rod will push in another 1/32 in. If it does, the clearance between piston and cylinder cover is O.K. If not, adjust by screwing the piston-rod in or out of the crosshead, as the case may be. When you have the right position, drill a No. 53 hole through crosshead and screwed end of piston-rod, and squeeze in a stub of $\frac{1}{16}$ in. steel wire. On re-connecting the rods, and putting the coupling rods on, the whole lot should work sweetly when the wheels are turned by hand, with no tight places anywhere. Next stage, the valve gear.

Where is the Proof?

Suppose your humble servant made the following statement—"I, 'L.B.S.C.,' claim that I made the first atom bomb in 1908, long before the U.S.A. scientists ever thought of it"; readers of these notes would promptly say

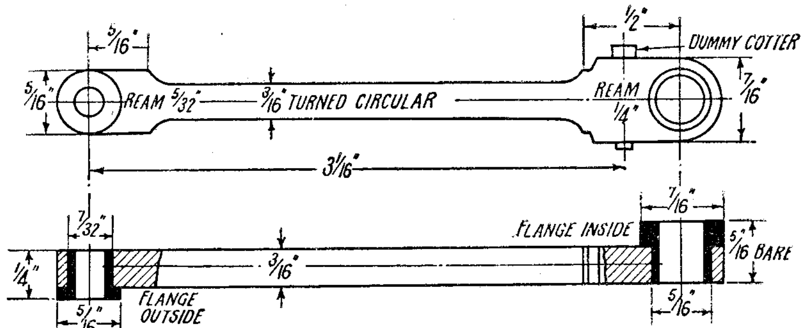
"Don't talk tommy-rot! Where is your proof? Where are your reliable witnesses? Why didn't you leap to fame by announcing it at the time, instead of letting other people claim the credit for a mere trifle of 44 years or so?" Exactly! Well, the "steam" part of the claim by Mr. A. L. Lee, in the issue of July 31st last, is in precisely the same category. A little simple analysis will prove that it isn't worth the paper it is written on. Whilst I appreciate Mr. Lee's efforts on behalf of his late brother, I submit that he should have remembered that a claim *without one jot or tittle of concrete evidence* that the engine hauled passengers in 1908, wouldn't be upheld for one minute in any court of law. Now it so happens that certain information regarding the locomotive in question, has reached me from several quarters, and points to the fact that it was not built in the form in which it now exists; even if it is now capable of hauling passengers, it is because it has been altered, amended, or rebuilt according to the principles laid down in these notes. My correspondence tells of many other locomotives of similar size, that were so rebuilt.

First of all, it is rather late in the day for Mr. A. L. Lee to make his claim; it is very easy for anybody to follow a well-signposted road to a destination, and then say he was the first to arrive! When I stated, at the time of the "Battle of the Boilers," that it was possible to haul live passengers with a 2½-in. gauge locomotive burning coal, I was laughed at, sneered at, and—not to put too fine a point on it—called a damned liar. Would that have been the case if somebody else had built a coal-fired passenger-hauling locomotive of similar dimensions between 12 and 15 years before? Bless your hearts and souls! If I know anything about human nature, that "somebody" wouldn't have let me get away with it, after I took my locomotive to the Caxton Hall, and proved my contentions in the presence of over a hundred people! Mr. A. L. Lee hasn't the slightest tangible evidence that his brother's engine ever hauled a living load before mine did; and from the information about it which has reached me, I suggest that it was originally built from commercial castings and parts, to commercial specifications. Why, for instance, did it have a pressure gauge *in the tender*?

The Facts

Actually, live passenger-hauling on 2½-in. gauge was an accomplished fact long before the date of Mr. A. L. Lee's claim, but not by coal-fired engines. I have here at the present moment, a catalogue issued by James Carson & Co. Ltd., then in business at 51, Summer Row, Birmingham, in August, 1907. The frontispiece of this shows a 2½-in. gauge 4-6-0 *Cardean* hauling a small boy (Carson junior—I corresponded with him up to the outbreak of the Hitler war) and the price of this locomotive, complete, ready for the road was—don't faint!—eleven pounds ten shillings. It was fully guaranteed to do the above job, and keep on doing it. Several other types of locomotives were also listed, at similar prices. Sets of castings and parts, were also sold for building the locomotives. Now the engine illustrated at the head of Mr. A. L. Lee's article, which he claims to have been built by his brother between 1908 and 1910, is suspiciously like the North British Atlantic illustrated on page 11 of the above-mentioned catalogue; in fact, it tallies with it in every respect, except that the Carson engine has a water-tube boiler with a Belpaire firebox. The cylinders, wheels, and other dimensions *are exactly the same.* The evidence is, that the engine built by Mr. Lee's brother was made from castings and parts supplied for this engine, and the coal-fired boiler and pump were much later additions, fitted after I had described coal-fired Atlantic boilers in these notes. A close inspection of the photo-reproduction of Mr. Lee's engine, on page 145 of the issue for July 31st last, would indicate that the running-boards have been cut behind the driving splasher to accommodate the wide firebox, which extends well into the cab, almost to the drag beam. The engine was certainly *not* built as a Great Northern Atlantic; the running-board above the cylinders is good evidence of that, and G.N. engines didn't have side clacks on the boiler barrel—but *Ayesha* had them!

I had a pleasant chat with Mr. James Carson at the "M.E." Exhibition of 1910 or 1911 (I forget which year now), and commenting on the picture of the 2½-in. gauge job pulling the boy, he said that they had tried one with a 10-stone passenger. It shifted him, but it was a struggle, so they never made a song and dance about it, preferring to advertise a feat that could be done any day and every day, by any of their engines of similar size. This was miles ahead of the four or five tin coaches hauled by engines advertised



Connecting-rod

by their competitors. However, with a little titivation, Carson's *could* have advertised continuous adult passenger hauling; my old friend and fellow-employee of the L.B. & S.C. Railway, Mr. W. E. Briggs, built an inside-cylinder 4-4-2 from Carson castings and parts. I made the Joy valve-gear for it. This engine had no difficulty in hauling an adult continuously; but she was oil-fired, with a home-made Carson-type burner. She did this job long before the "Battle of the Boilers," on several occasions in the presence of independent witnesses. She is still in existence.

Case Dismissed!

Before *Ayesha* came into being, there were a few stray 2½-in. gauge locomotives built with locomotive-type boilers; but the boilers were of antiquated design, and had very low firebox crowns, usually about five tubes, no superheater (the grid of short tubes in the smokebox was useless for superheating purposes) and usually a dry back to the firebox. Charcoal was the fuel used, and they were certainly not able to haul living loads continuously. I converted a couple of them in the early days of these notes, scrapping the old boilers and replacing them by my own type with higher firebox crowns and more tubes, plus proper firetube superheaters. It is hardly necessary to add that the valve gear also needed alteration! I also have here at the present moment, a 2½-in. gauge L.N.W.R. "Precursor" as described in the Carson catalogue mentioned above (price £7 7s. od.!) which has one of my own coal-fired boilers and a proper Joy valve gear. She has no trouble in hauling George Barlow and Bob Hobbs, of the Romney, Hythe & Dymchurch Railway—together, not one at a time—continuously; but she couldn't do anything like that when she first left Carson's works!

Anyway, to sum up, Mr. A. L. Lee's claim that his brother built the first passenger-hauler on 2½-in. gauge can be dismissed for lack of evidence and proof. My old *Ayesha* was the first to do the job in public, and still does it. I also gave the first demonstration of live passenger hauling on the 1¾-in. gauge, at the Caxton Hall in 1924, with a 4-6-4 tank engine similar to the Hughes engines on the old "Lanky and York"; and finally, my gauge "O" *Sir Morris de Cowley*, Southern *King Arthur* type enlarged into a 4-6-2, "astonished the natives" at the Kingsway Hall, in 1926, by hauling a wide gauge car carrying an adult passenger. Hearsay is no evidence, but seeing is believing!

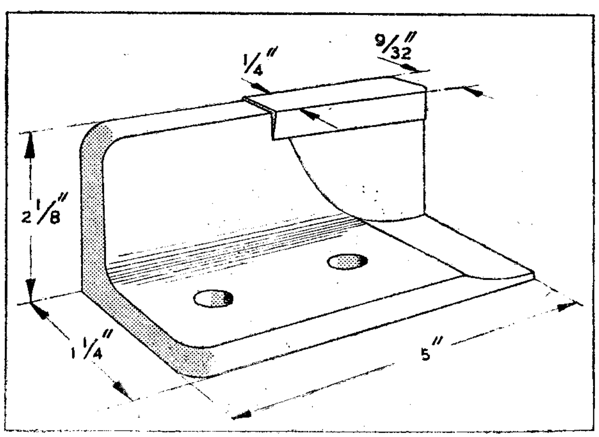
A Crankpin Turning Tool

I HAVE read many accounts in the pages of this journal, on the subject of turning small crankshafts from the solid. Very little mention is made of what I have found to be the chief difficulty, that is, the excessive overhang of the tool required for machining the crankpins and between the webs. In order to overcome this, I fitted my 3⅜-in. Super Exe treadle-operated lathe with the tool about to be described.

This tool, which is intended to bolt directly on to the lathe boring table, is made from a piece of 2¼ in. × ⅜ in. thick angle-iron, 5 in. long and a piece of 5/16 in. square high-speed steel tool-bit.

Before commencing, I think it is essential to ascertain the centre height from the boring table. This should be done with a test indicator, in order to obtain close accuracy.

The piece of angle-iron is cut to the sizes given and then the side and underneath squared off. Suitable holes are drilled and spotfaced for clamping down. It should be noted how the angle is reduced in thickness to about 15/64 in. below the tool-bit. This may be done by a milling or turning operation. The tool-bit is first backed off from 9/32 in. wide at the cutting edge to ¼ in. wide at the back, these dimensions being suitable for a carnkshaft of 5/16 in. between the webs. Then a clearance of about 5 deg. is given to both sides and the front ground quite square with a front clearance angle of 7 deg. The radii on the corners of the cutting edge should be carefully ground and honed to about 1/16 in., giving a nice corner radius to the work. The prepared piece of angle-iron should then be notched out to receive the tool-bit, and after slightly roughening the mating surfaces, the tool-bit is silver-soldered in position as described on page 798, "M.E.," July 1st, 1950. Emphasis should be made on keeping the exact centre height.



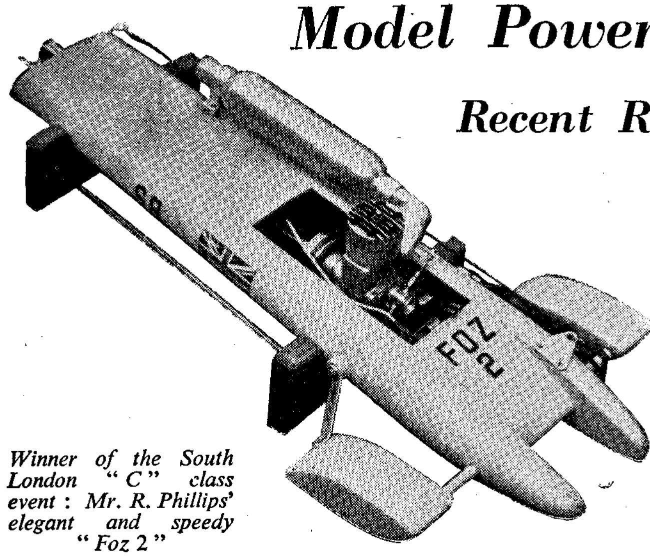
A crankshaft for a 3½-in. gauge "King" has been machined with this tool, from a 2 in. square section bar of annealed cast-steel, the balances being built on afterwards. During the machining operations it was only necessary to touch up the cutting edge occasionally with an oil stone.

—F. E. KNAPP.

Model Power Boat News

Recent Regatta Activities

by "Meridian"



Winner of the South London "C" class event: Mr. R. Phillips' elegant and speedy "Foz 2"

THE South London M.E.S. recently held their second regatta of the season—this time for racing boats only. In spite of very showery weather, a good turnout of boats contested the various events.

The fastest speed was recorded in the Class "A" race by E. Clark's *Gordon* 2, which attained 61.9 m.p.h. for the five laps. This boat has been running very well lately, and has consistently returned fast times—mostly around the 60 m.p.h. mark.

An unusual race, open to all classes of hydroplane, is the "Daisy Rowland" Trophy, run over 2,000 yards. Twenty laps is a very long way for most boats, and only in Class "A" is there an official record for a comparable distance. This is by K. Williams's *Faro*, which holds the 1,800 yard record at 48.7 m.p.h.

Many boats did not attempt this marathon, which was the last event to be run, and only two boats finished the full distance—B. Miles' *Barracuda* and N. Hodges's *Michael*, the former at 47.7 m.p.h. Both these of boats are in Class "A."

When this event was held last year, a Class "C" boat was the only one to finish, so that this season's result can be taken as a 100 per cent. improvement!

Results

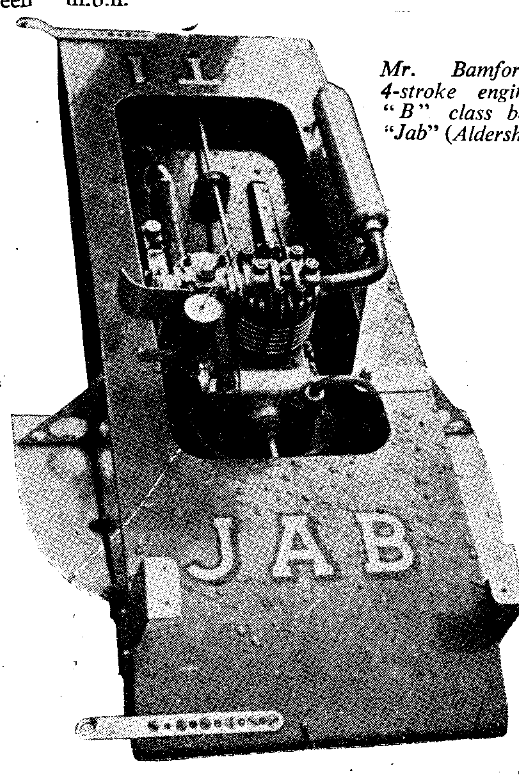
Class "." 500 yd.
(1) R. Phillips (S. London), *Foz* 2: 56.19 m.p.h.
(2) B. Miles (Kingsmere), *Dragonfly* 3: 51.14 m.p.h.

"C" Restricted. 500 yd.
(1) W Everitt (Victoria), *Nan*: 56.82 m.p.h.
(2) W. Everitt (Victoria), *Bill*: 55.88 m.p.h.

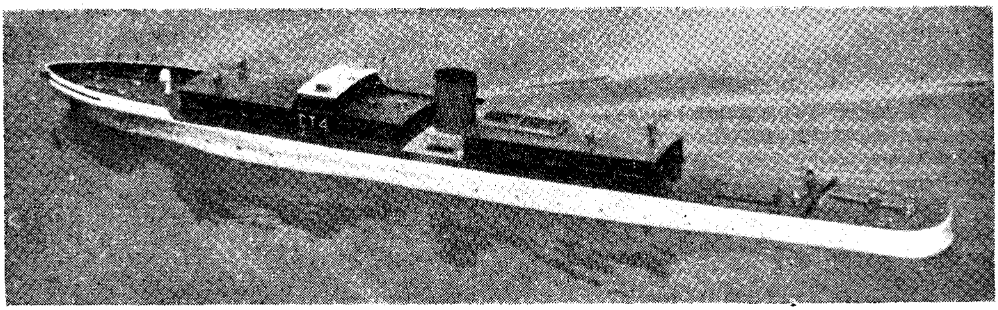
Class "B." 500 yd.
(1) G. Lines (Orpington), *Sparky* 2: 56.82 m.p.h.
(2) L. Pinder (Kingsmere), *Rednip* 7: 41.24 m.p.h.

Class "A." 500 yd.
(1) E. Clark (Victoria), *Gordon* 2: 61.99 m.p.h.
(2) G. Lines (Orpington), *Big Sparky*: 48.7 m.p.h.

Daisy Rowland Trophy. 2,000 yd.
(1) B. Miles (Kingsmere), *Barracuda*: 47.7 m.p.h.
(2) N. Hodges (Orpington), *Michael*: 32.4 m.p.h.



Mr. Bamford's 4-stroke engined "B" class boat "Jab" (Aldershot)



Mr. C. Nicholls' steam launch " Endeavour " in the steering competition

An Army " Regatta "

In response to an invitation by the Farnborough S.M.E., a number of well-known exponents visited Hawley Lake, Farnborough, on a recent Saturday. This event was to be part of an Aquatic Fete organised by the Royal Engineers' depot at Hawley.

The lake is situated in the centre of the large training area, and the transport of the visitors was thoroughly tested when negotiating the roads. These " roads " are apparently used for testing tanks, jeeps, etc., in rough conditions!

It was intended to provide a pole for the speed boats and, in fact, one had been set up several days prior to the event. However, the " powers that be " decided that the position was not very suitable, and required its removal to a place nearer the main events, side-shows, etc. So well had the Army put this pole in that it required dynamite to get it out! Subsequently another pole set up in the new position was damaged by a high-speed landing craft. It should be mentioned here that Hawley Lake is very large indeed, with various islands, etc., scattered here and there.

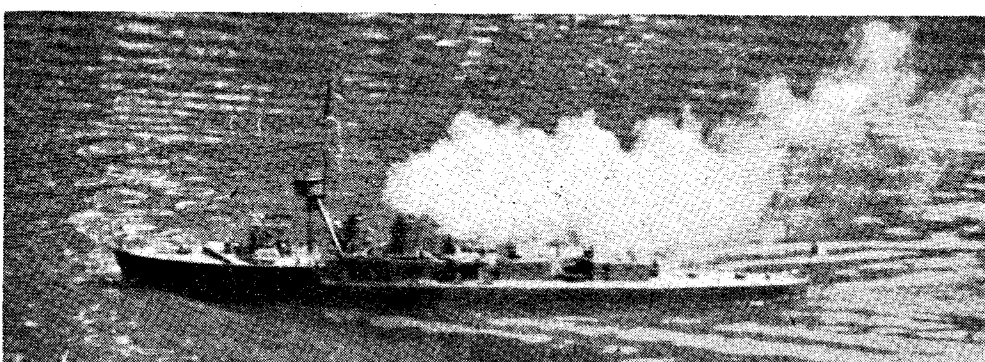
When the boating visitors arrived, efforts were being made to insert pole No. 3 from a boat. Unfortunately, there was a stiff breeze blowing, and the squad in the boat got into difficulties; in the end the pole slipped and disappeared in the murky depths. Nothing daunted, a frogman with full equipment went to look for it—without any luck, however, as it was too black to see anything.

After this catastrophe, the workshops quickly made pole No. 4, and eventually this one was successfully put in. Two frogmen, up to their necks in water, held it upright, while some well-known boating types managed the bashing-in process from a dinghy—the squad having by this time disappeared. Incidentally, the poles were 3 in. dia. steel tubing about 10 ft. long, and certainly took plenty of hammering in.

It was a pity that, after all these efforts, conditions were so poor that few boats would stay on the water for more than a few laps. *Sparky 2* did one and a half laps before capsizing, but Mr. Bamford, with *Jab*, managed four laps before the engine stalled. Eventually the Farnborough " Pot " was won by Mr. J. B. Skingley's *Josephine* running round at 8 m.p.h.!

Josephine, which is fitted with a four-cylinder " Seal Major " 30 c.c. engine, also gave a demonstration of towing, and some other boats, R. O. Porter's *Slickery*, R. Dinelli's *Conquest*, and W. Phillips's *Kenvera* gave straight-running demonstrations.

The visitors throughly enjoyed the day's sport, and most of them, along with their families, sampled the various other attractions of the fete.



Mr. Dinnelli's cruiser " Conquest " in the Southampton nomination race

Southampton Regatta

On the day following the Farnborough effort the Southampton and District S.M.E. regatta was held and all the Farnborough competitors continued on their way south, becoming gypsies for one night only!

Southampton Common is the venue for this annual event, and in addition to the regatta programme, the locomotive men had set up their portable track, giving free rides to kiddies, etc., so that the general public had plenty to see and interest them.

Among the visitors were members of the Bournville, Swindon, Cheltenham, and Portsmouth clubs, besides the London contingent, so that all the races and events had good entries. The Steering event was won by W. Hood (Swindon), with *Truant*, after a tie with J. Slender (Welling) with *Sarah Ann*. The Nomination race went to Mr. Perman's coal-fired tug *Smoky* (W. London) a fine boat whose regatta appearances are all too few.

Good speeds were the order of the day in the speed events, but the outstanding wins were in the Class "B" and Class "A" races. In the former, J. Rose (Coventry) with *Meteor I*, recorded 58.2 m.p.h., which goes down as the best 15 c.c. four-stroke performance to date. The engine is a modified "Kittiwake" design, as described in these pages by Mr. E. T. Westbury many years ago, and is still worthy of attention by speed boat men.

In Class "A," B. Pilliner's flash steamer *Frolic* did 54 m.p.h., to win the event, and in a demonstration run after the regatta, an officially-timed run of over 58 m.p.h. was made. This is the best performance ever made by a flash-steam boat and will take some beating.

Concurrently with the 500 yd. races was a 1,000 yd. event for all comers. Competitors had the option of going on for the 1,000 yd. in each of their normal runs. The winner was W. Everitt with *Nan*, which speeded up on the last five laps to record 63.5 m.p.h. for the thousand yards.

Results

Nomination Race

(1) Mr. Perman (W. London), *Smoky*: 1.54 per cent. error.

(2) Mr. Kirkham (Swindon), *Kenmore*: 1.6 per cent. error.

Steering

(1) W. Hood (Swindon), *Truant*: 11 + 5 + 5 points.

(2) J. Slender (Welling), *Sarah Ann*: 11 + 5 + 1 points.

Class "D" 500 yd.

(1) K. Hyder (Victoria), *Slipper I*: 45 m.p.h.

(2) Mr. Trodd (Southampton), *Ritzy*: 23.2 m.p.h.

Class "C" 500 yd.

(1) B. Miles (Kingsmere), *Dragonfly 3*: 58.4 m.p.h.

(2) F. Walton (Kingsmere), *Jolt 3*: 44.47 m.p.h.

"C" Restricted, 500 yd.

(1) W. Everitt (Victoria), *Nan*: 57.46 m.p.h.

(2) W. Everitt (Victoria), *Bill*: 56.7 m.p.h.

Class "B" 500 yd.

(1) J. Rose (Coventry), *Meteor I*: 58.2 m.p.h.

(2) G. Lines (Orpington), *Sparky 2*: 56.8 m.p.h.

Class "A" 500 yd.

(1) B. Pilliner (Southampton), *Frolic*: 54 m.p.h.

(2) J. Benson (Blackheath), *Orthon*: 52.4 m.p.h.

TRADE TOPICS

Model Ship Fittings

We frequently receive enquiries from model engineers, especially those who build prototype steamers, for a source from which they can obtain deck and other fittings for their models. In the old days a number of firms produced such fittings, but since the war the supply has been very limited. Recently, however, we received from The Web Model Fitting Co., 204, High Road, Wood Green, London, N.22, their new catalogue, which supplies the complete answer to such requests. Every possible kind of ship's fittings seem to be included, and there is a range of most of them to suit any reasonable scale. For instance, steering wheels are supplied in wood from ½ in. to 2 in. diameter, and in metal from ⅝ in. to 2 in. diameter. Propellers are made with two or three blades and from 1½ in. to 3 in. dia. in each type. Fittings are supplied for model steamers, yachts, sailing ships, warships—old and new—in fact, the list seems to cover the entire field of ship modelling. Boilers, pressure gauges, oscillating engines, slide-valve cylinders and a wide range of steam fittings, are included. Accompanying the catalogue we received a number of specimen fittings: these were of good design, good quality and well finished, and we have every confidence in recommending them. The catalogue, which is beautifully illustrated, is well worth its price of 2s. 6d., and should be in every shipmodeller's possession.

Model Road Racing Tyres

We recently received from Mr. Henri Baigent, of 10, Beverley Gardens, Ensbury Park, Bournemouth, samples of his latest scale tyres, with Dunlop and Pirelli-type treads. These have come at a time when a great demand appears to be building up, and they can be recommended as the nearest to perfection we have seen.

The 16 × 550 Pirelli, 1¼ in. = 1 ft. scale, are priced at 16s. 6d. each; also available in this range is a 16 × 700 at 18s. each. The Dunlop pattern, 16 × 750, 1/12th scale, at 12s. 6d. each, and a ribbed 16 × 50 also 1/12th scale, price 9s. 6d. each. The 1/12th scale Cooper tyres, Dunlop pattern, 15 × 600 and 15 × 450 are 6s. 6d. each.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed : "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

In all cases, the fullest possible particulars of the problem should be given, and in the case of electrical queries dealing with windings, etc., all dimensions of rotor or stator, slots or space available on transformer limbs, and cross-section of cores are essential.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibily by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query ; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

Queries involving the valuation of models or any matters concerned with buying and selling new or second-hand models, cannot be entertained.

No. 9969.—Silencer for Two-stroke Engine D.E.H. (Harrow)

Q.—I have installed a 6-c.c. two-stroke engine in a 50 in. motor cruiser, and to comply with local restrictions I have to fit this engine with a silencer. Will you please advise me on the following points :

(a) The best available type of material for exhaust pipe.
(b) The volume of silencer chamber.
(c) Material to use for packing silencer.

R.—There is very little information available on the design of silencers for small engines, but generally speaking, it is found that the most satisfactory silencer for small two-stroke engines is an expansion chamber not less than five times the volume of the cylinder displacement and fitted as close to the cylinder as possible. With regard to your specific questions :

(a) The exhaust pipe may be made of steel, copper or aluminium alloy, according to convenience in construction or fabrication.
(b) Has already been answered as above.
(c) The question as to whether any packing at all should be used will depend on various circumstances, such as accessibility of the silencer for fairly frequent inspection and cleaning. Steel wool packed into the silencer helps to suppress the noise, but it has the disadvantage of retaining oil, so that the silencer is liable to become choked, especially with the high concentration of oil used with small engines. In some cases it is not advisable to use any kind of baffles in the silencer, as many two-stroke engines will not tolerate the slightest back pressure. The exhaust stub of the engine could be brazed or welded to the silencer, or alternatively replaced by a flanged pipe fitted on the silencer itself.

No. 9977.—Wire for Choke Coils T.B.C. (Quarry Bank)

Q.—Can you tell me what amount, and what gauge of wire should be used to wind a "choke coil" for a small arc-lamp, say 8 A, or an a.c. mains supply of 200 V, on the lines suggested in THE MODEL ENGINEER booklet by A. W. Marshall?

R.—Choke coils used for the purpose of regulating an arc lamp or for welding are usually of the variable type. A choke coil that will suit your requirements is one of the open-core type. A bobbin should be made having a hole approximately $1\frac{1}{2}$ in. $\times$ $1\frac{1}{2}$ in. square. The length of the bobbin can be 8 in. The cheeks will be approximately $3\frac{1}{2}$ in. square. This bobbin is preferably made in metal, and a thickness of $\frac{1}{16}$ in. is suitable. The bobbin and the cheeks must be saw-cut right through on completion, so that the assembly does not form a path for current through the core part of the bobbin or the cheeks. Suitable metals for the bobbin would be brass, zinc, or aluminium ; either of the first two would be easier to use, as it is possible to solder the cheeks in position. Provision on one cheek must be made for an attachment to clamp the core in position ; this could be a short length of rod tapped a suitable size to take a set-screw. The iron core can be made from old transformer stampings, which may be cut from thin soft sheet iron. After completing the bobbin, it should be insulated with 10 mil. thickness of leatheroid or thin Presphan. The cheek sections should be in two pieces assembled with the cut in opposite positions on the cheek. A suitable winding for this choke would be 900 turns of 12-s.w.g. plain enamel covered copper wire, and no insulation is needed between the layers. In use, the core is adjusted to whatever position is required and then clamped in position by the set-

screw. When using a choke coil with an arc lamp, it is usual to provide a resistance so as to obtain fine adjustment during operation. If you arrange for the core to be fed in and out of the bobbin by a suitable screw adjustment on the core, the resistance would not be necessary.

No. 9971.—Material for Making Cylinders
R.G.D. (Portsmouth)

Q.—Will you please advise me whether it is practicable to use mild-steel for the cylinders of a four-cylinder single-acting steam engine? Could a mild-steel cylinder be used in conjunction with a cast-iron piston and should the cylinder be case-hardened? Is it in order to use a phosphor-bronze piston in conjunction with mild-steel liners? It is proposed to use a boiler of the semi-flash type working at 100 lb. per sq. in.

R.—It is quite practicable to use mild-steel in cylinders of steam engines working on saturated steam, or with a moderate degree of super-heat, but this material is less satisfactory, from the point of view of wear and corrosion resistance, to cast-iron, which is generally preferred by most engine constructors, particularly for engines which have to withstand continuous running for long periods.

We note that you are proposing to use what you describe as a semi-flash type of boiler to supply steam to this engine, and we would point out that with this type of boiler, considerable fluctuations, both in the temperature and pressure of the steam, are possible.

It is practicable to use cast-iron pistons in connection with mild-steel cylinders, but in this case also, the use of cast-iron for both parts is preferable. We should not recommend using either brass or phosphor bronze pistons or piston-valves in cylinders of cast-iron or steel, as the higher co-efficient of expansion of these materials is greater than that of iron or steel, and there would be liability of the pistons or piston-valves seizing up at the high temperature.

No. 9976.—Converting D.C. to A.C.
J.D. (Bolton)

Q.—Would you please advise me on the conversion of d.c. to a.c. motors? I have two 1/3 h.p. d.c. 230 V shunt wound motors 2,400 r.p.m. 1.2 A current consumption and have been running one as a rotary interrupter, using an old commutator. Could you advise me on the speed of rotation, number of segments, and approximate output in watts? The frequency desired may be 50 cycles, 500 c/s or 1,00-2,000 c/s, as transformers for these frequencies may be obtained easily. I have also been offered an engine-driven alternator 80 V, 1,300-2,600 c/s, 500 W, excitation 24 V. Would 1/3 h.p. motor drive the unit to give 150 W a.c. maximum?

R.—The interrupter method is not a good way of obtaining an a.c. supply but it certainly suits some applications. The number of bars do not matter; you want to obtain 50 cycles per second, so you will arrange the bar assembly to give 50 interruptions at any speed you may choose. As your motors are shunt wound, it would be possible to convert them into rotary converters. You can do this by two methods. One is to turn a ring so as to extend the back end bearing bracket; on the space gained inside the motor a set of slip-rings could be mounted. The second method would be to drill a hole through the shaft at the pulley end to reach the position between the winding and the back bearing. Another hole would then be drilled down through the shaft to meet this hole and a set of rings mounted external to the motor. In either case, the tap connections could be brought through a convenient slot. There may be room for this without removing the slot wedge, otherwise the wedge can be knocked out and the lead brought through the slot under the wedge. In the first case, a wedge must be provided to keep the lead in place. The connections to the slip-rings are taken from exactly opposite positions on the commutator, one connection to each ring. To obtain a frequency of 50 cycles per sec. the speed of the motor requires to be 3,000 r.p.m., therefore, the speed of yours must be raised. This is easily carried out by the use of a resistance in series with the field coil circuit of the motor, and the value of this resistance can be calculated if the field current is known. This can be measured by an ampmeter, and the resistance fixed, but it might be convenient to arrange it as a variable one, which would enable you to control the speed should the supply pressure vary.

The 1/3 h.p. motor should be sufficiently powerful to drive the alternator in theory. Everything will centre on its efficiency, and it is possible that considerably more power than 1/3 h.p. may be required. The field excitation could easily call for more than half the available power. However, no harm will be done if you try the set-up out, when you will see where you stand.

No. 9970.—Overhauling a Church Clock
J.B. (Witney)

Q.—I propose to overhaul a village church clock, which is over 200 years old. The bearings and pivots are badly worn. Will you please inform me if there is any technical objection to the fitting of ball-races to the pinion arbors where most of the wear takes place? I have never heard of this being done before, and would like your advice before proceeding.

R.—There are technical objections to the use of ball-races as you suggest in the repair of a church clock.

In the first place, the advantages of a ball-race would be wasted in such a slow moving train. Secondly, and of much more importance, is the fact that the whole train moves in "jerks" due to the escapement, and the balls would cause indentation in the races due to resting under load in one spot and then suddenly being moved a fraction and just as suddenly checked—with the accompanying recoil. Ball-races are intended for a more even motion, and we suggest that you work on conventional lines.